Aqua-Hot™

By Vehicle Systems, Inc.

Motor Coach Heating Specialists

Shop Manual

Model Numbers

AHE-100-04S - 12 VDC AHE-120-04X - 12 VDC AHE-130-04X - 12 VDC

Rev. B
November - 2012

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Fill / Radiator Cap

Circulation Pump #1

VAC Service Input

Circulation Pump #2 VAC Access Cover

Circulation Pump #3

Hour Meter

Engine Preheat Circulation Pump

Thermostat Access Cover

MarkingDiesel-Burner Plates

Head Electric Heating Element Access

Engine Coolant

Supply

Cover

Boiler Tank Drain Valve

Diesel Fuel Supply

Diesel-Burner Controller

Diesel Fuel Return

Pressure-Relief Valve

Hot Water Outlet (Domestic Water)

Figure 1

Mixer Valve

Cold Water Inlet (Domestic Water)

Engine Coolant Return

Marking 1.2 Marking Plate Plate

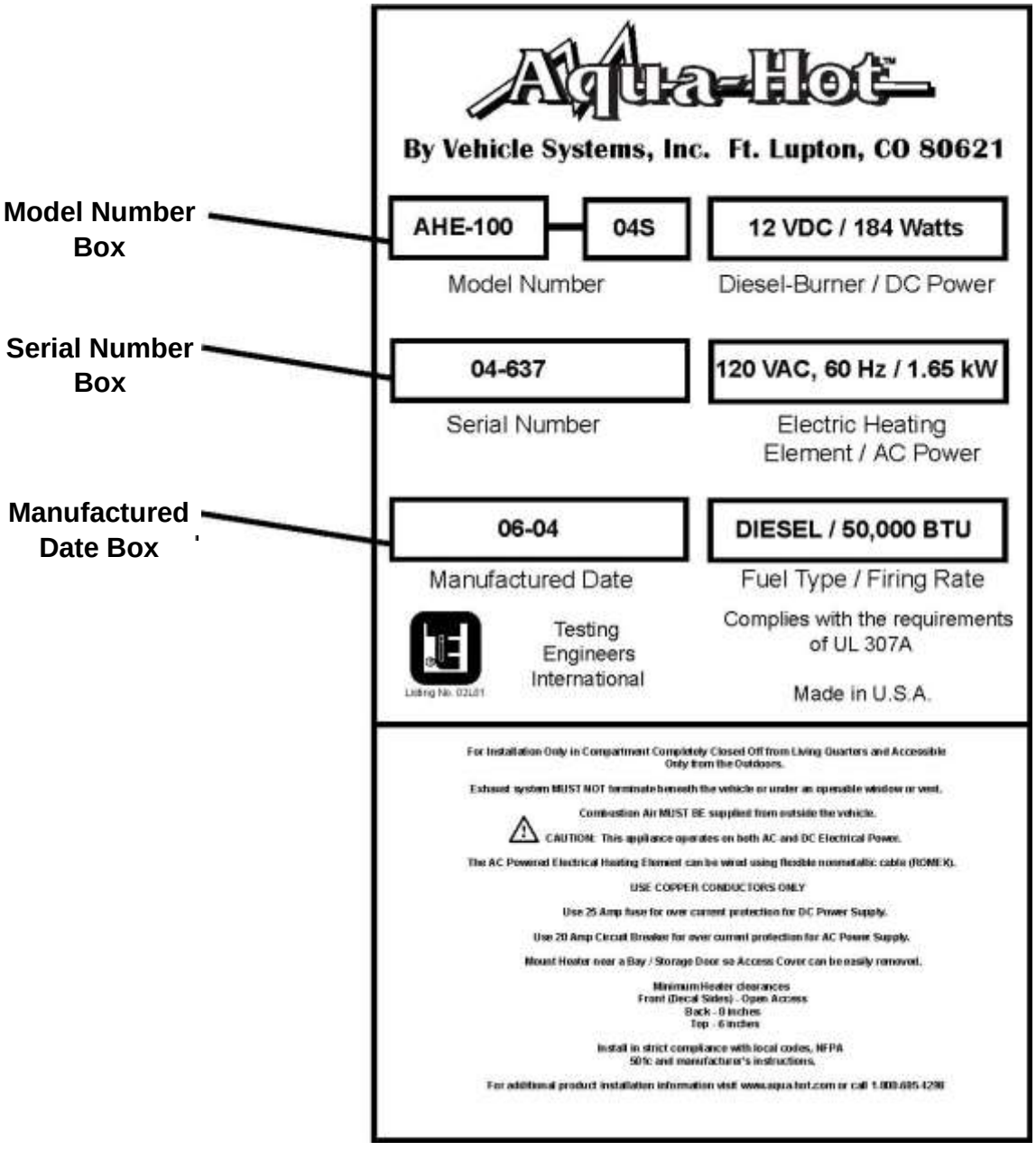

Model Number Box
Serial Number Box
Manufactured Date Box
Aqua-Hot
By Vehicle Systems, Inc. Ft. Lupton, CO 80621
AHE-100
04S
12 VDC / 184 Watts
Model Number
Diesel-Burner / DC Power
04-637
120 VAC, 60 Hz / 1.65 kW
Serial Number
Electric Heating Element / AC Power
06-04
DIESEL / 50,000 BTU
Manufactured Date
Fuel Type / Firing Rate
Testing Engineers International
Complies with the requirements of UL 307A
Made in U.S.A.
For Installation Only in Compartment Completely Closed Off from Living Quarters and Accessible Only from the Outdoors.
Exhaust system MUST NOT terminate beneath the vehicle or under an openable window or vent.
Combustion Air MUST BE supplied from outside the vehicle.
CAUTION: This appliance operates on both AC and DC Electrical Power.
The AC Powered Electrical Heating Element can be wired using flexible nonmetallic cable (ROMEX).
USE COPPER CONDUCTORS ONLY
Use 25 Amp fuse for over current protection for DC Power Supply.
Use 20 Amp Circuit Breaker for over current protection for AC Power Supply.
Mount Heater near a Bay / Storage Door so Access Cover can be easily removed.
Minimum Heater clearances
Front (Decal Sides) - Open Access
Back - 0 inches
Top - 6 inches
Install in strict compliance with local codes, NFPA 501c and manufacturer's instructions.
For additional product installation information visit www.aqua-hot.com or call 1.800.685.4298

Figure 2

Reference Figure 1 for Marking Plate locations.

Aqua-Hot 2.1 Aqua-Hot Model Differentiation Models

Vehicle Systems, Inc. manufactures three individual models of the *Aqua-Hot Hydronic Heating System*. The varying factor between these three models is the number of *Electric Heating Elements* featured, as well as the voltage employed by each *Electric Heating Element*. In order to determine which of the following Aqua-Hot models has been employed, locate the *Marking Plate* on the Heating System (reference Figures 1 and 2 for Marking Plate information) and view the *Model* number.

AHE-100-04S:

This model features a single 120 VAC/1650 Watt *Electric Heating Element*.

NOTE: Reference "Appendix A" for Wiring Diagram.

NOTE: Reference "Appendix A" for Wiring Diagram.

AHE-120-04X:

This model features one *120 VAC/1650 Watt Electric Heating Element* and one *240 VAC/4500 Watt Electric Heating Element*.

NOTE: Reference "Appendix A" for Wiring Diagram.

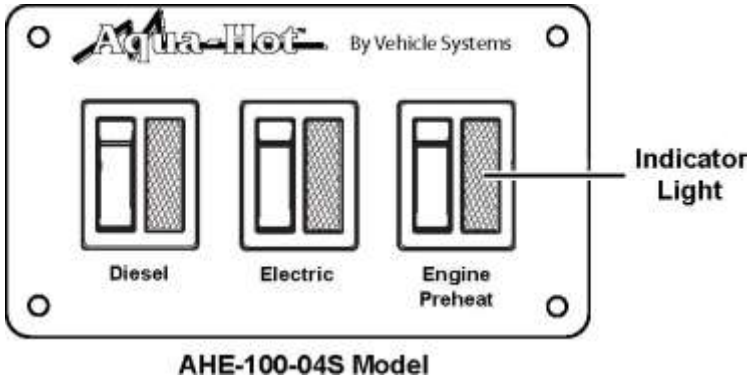
NOTE: Reference "Appendix A" for Wiring Diagram.

AHE-130-04X:

This model features two *120 VAC/2000 Watt Electric Heating Elements*.

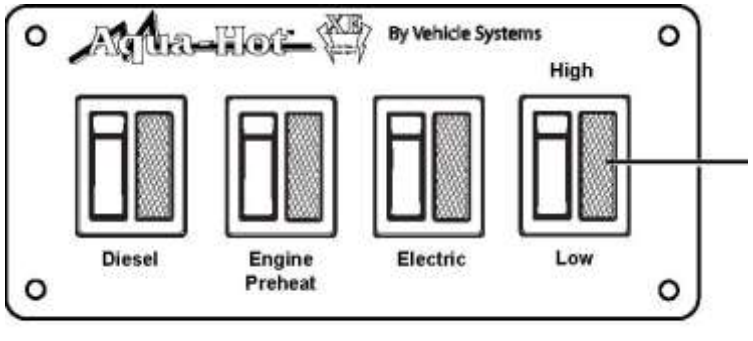
NOTE: Reference "Appendix A" for Wiring Diagram.

NOTE: Reference "Appendix A" for Wiring Diagram.



AHE-100-04S Model

Figure 4



AHE-120-04X and AHE-130-04X Models

Indicator Light

Switch Panel 3.1 Interior Switch Panel

The *Interior Switch Panel* serves as an interior means of controlling the separate heating sources of the *Aqua-Hot*, as well as activating the *"Engine Preheat"* system, when necessary. The AHE-120-04X and AHE-130-04X dual element *Heating Systems* feature a *"High/Low"* switch, in addition to the *"Diesel," "Electric,"* and *"Engine Preheat"* switches, as utilized by all three *Aqua-Hot* models; reference Figure 4. Please reference sections 3.2, 3.3, and 3.4 for information regarding the functions of the *Interior Switch Panel*.

3.2 Diesel Switch

Function: The "*Diesel"* switch activates the *Diesel-Burner*, thereby illuminating the indicator light on the switch; reference Figure 4. This procedure allows the *Diesel-Burner* to operate, which supplies heat to the Aqua-Hot's *Boiler Tank*. The *Diesel-Burner* will heat the *Aqua-Hot System* to the maximum operating temperature (190°F (+/- 5 degrees)) in approximately 10-20 minutes. Please note that the *Diesel-Burner* is the Aqua-Hot's **primary heat source** for heating both the interior and/or the domestic hot water (such as when cool ambient temperatures exist and/or when there is a high demand for domestic hot water). It should also be noted that the *"Diesel"* switch indicator light will turn off anytime the *Diesel-Burner* malfunctions.

Additionally, the *"Diesel"* switch serves as a method of resetting the *"Low Battery Voltage Fault."* This reset can be accomplished by turning ***OFF*** the *"Diesel"* switch for approximately 30 seconds, then turning the switch back ***ON***; reference Section 4.4 and 4.11.

3.3 Electric Switch

NOTE: The *Electric Heating Element(s)* is the Aqua-Hot's **secondary heat source** for heating both the interior and/or the domestic hot water during low heating demand situations (such as when moderate ambient temperatures exist and/or when there is a low demand for domestic hot water). This feature is only operational whenever the Motorhome is connected to VAC power or when the generator is operating.

NOTE: The *Electric Heating Element(s)* is the Aqua-Hot's **secondary heat source** for heating both the interior and/or the domestic hot water during low heating demand situations (such as when moderate ambient temperatures exist and/or when there is a low demand for domestic hot water). This feature is only operational whenever the Motorhome is connected to VAC power or when the generator is operating.

AHE-100-04S Model

Function: The *"Electric"* switch activates the Aqua-Hot's *Electric Heating Element*, thereby illuminating the indicator light on the switch; reference Figure 4. This procedure allows the *120 VAC Electric Heating Element* to supply heat to the Aqua-Hot's *Boiler Tank*. The *120 VAC Electric Heating Element* will heat the *Aqua-Hot System* to the maximum operating temperature (190°F (+/- 5 degrees)) in approximately 1-2 hours.

AHE-120-04X Model

Function: The *"Electric"* switch, in conjunction with the *"High/Low"* switch, activates the Aqua-Hot's *Electric Heating Element(s)*, thereby illuminating the indicator light on the switch; reference Figure 4.

Low:

The process of moving the *"High/Low"* switch to the ***"Low"*** position, in conjunction with the activation of the *"Electric"* switch, allows the *120 VAC/1650 Watt Electric Heating Element* to supply heat to the Aqua-Hot's *Boiler Tank*. The *120 VAC/1650 Watt Electric Heating Element* will heat the *Aqua-Hot System* to the maximum operating temperature (190°F (+/- degrees)) in approximately 1-2 hours.

Switch Panel,
continued

High:
The process of moving the *"High/Low"* switch to the ***"High"*** position, in conjunction with the activation of the *"Electric"* switch, allows both the *120 VAC/1650 Watt* and the *240 VAC/4500 Watt Electric Heating Elements* to supply heat to the Aqua-Hot's *Boiler Tank*. The *120 VAC/1650 Watt* and *240 VAC/4500 Watt Electric Heating Elements* will heat the *Aqua-Hot System* to the maximum operating temperature (190°F (+/- 5 degrees)) in approximately 0.5-1 hour.

AHE-130-04X Model

Function: The *"Electric"* switch, in conjunction with the *"High/Low"* switch, activates the Aqua-Hot's *Electric Heating Element(s)*, thereby illuminating the indicator light on the switch; reference Figure 4.

Low:
The process of moving the *"High/Low"* switch to the ***"Low"*** position, in conjunction with the activation of the *"Electric"* switch, allows one *120 VAC/2000 Watt Electric Heating Element* to supply heat to the Aqua-Hot's *Boiler Tank*. The *120 VAC/2000 Watt Electric Heating Element* will heat the *Aqua-Hot System* to the maximum operating temperature (190°F (+/- 5 degrees)) in approximately 1-2 hours.

High:
The process of moving the *"High/Low"* switch to the ***"High"*** position, in conjunction with the activation of the *"Electric"* switch, allows both *120 VAC/2000 Watt Electric Heating Elements* to supply heat to the Aqua-Hot's *Boiler Tank*. These *120 VAC/2000 Watt Electric Heating Elements* will heat the *Aqua-Hot System* to the maximum operating temperature (190°F (+/- 5 degrees)) in approximately 0.5-1 hour.

3.4 Engine Preheat Switch

Function: The *"Engine Preheat"* switch activates the Aqua-Hot's *Engine Preheat Circulation Pump*, thereby illuminating the indicator light on the switch; reference Figure 4. This procedure allows the *Engine Preheat Circulation Pump* to circulate the engine's coolant through a separate double-wall copper coil in the Aqua-Hot's *Boiler Tank*, resulting in a warm engine for easy start-ups in cool temperatures. Please note that this feature will be effective only if the *"Engine Preheat"* switch is ***ON*** in conjunction with either the *"Diesel"* and/or the *"Electric"* switch.

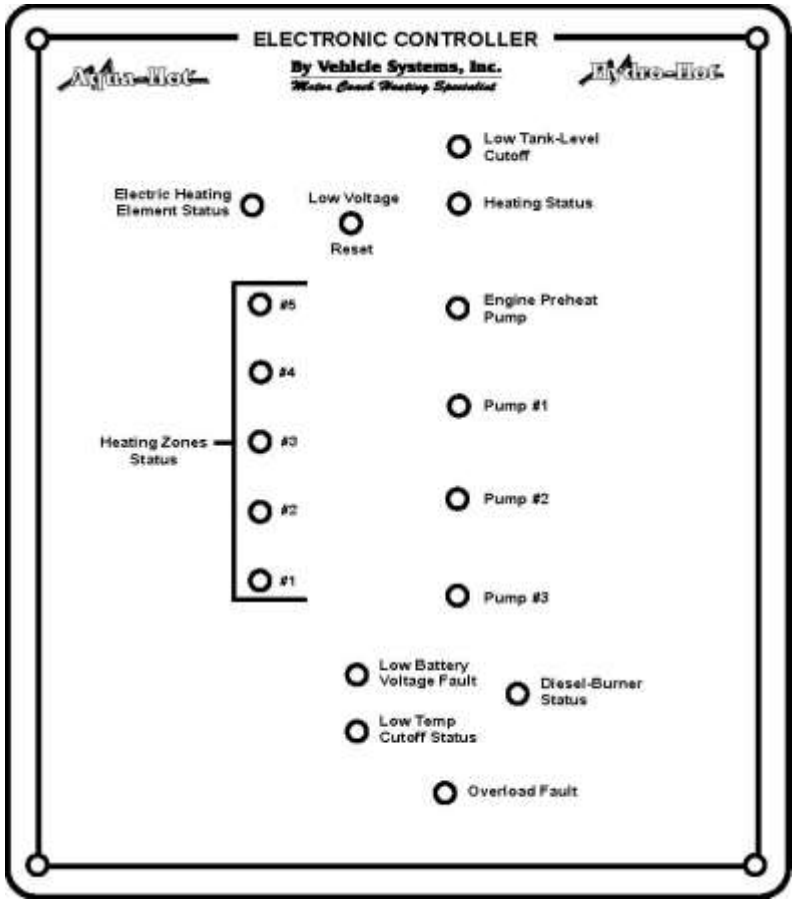


Figure 5

4.2 Electric Heating Element Status Indicator Light

This indicator light will illuminate GREEN whenever the Aqua-Hot's *120 VAC Electric Heating Element* is operating and providing the heat to the Aqua-Hot's *Boiler Tank*; reference Figure 5. Please note that this light will only be active if the "*Electric"* switch is in the ***ON*** position; reference Figure 4. If this indicator light illuminates RED, it indicates an electrical or overload condition (i.e., a short) has occurred in the Electric Heating Element's VDC powered circuitry.

4.3 Heating Zone Status Indicator Lights

These five indicator lights (separately) will illuminate GREEN whenever a *Zone Thermostat* for a particular zone is calling for heat; reference Figure 5. The GREEN indicator lights also indicate that VDC power is being supplied to the particular interior heating zone's *Heat Exchangers* (i.e., fan motors). If any of the five indicator lights illuminate RED, it indicates that an electrical overload condition (i.e., a short) has occurred in a particular heating zone's circuitry.

NOTE: A short, in either a heating zone's *Thermostat* or a heating zone's *Heat Exchanger* circuit, will cause the indicator light to illuminate RED.

NOTE: A short, in either a heating zone's *Thermostat* or a heating zone's *Heat Exchanger* circuit, will cause the indicator light to illuminate RED.

Electronic Controller, continued

4.4 Low Voltage Reset

The Aqua-Hot's *Electronic Controller* must be manually reset whenever the *Low Battery Voltage* fault indicator light has been activated; reference Figure 5. The *Electronic Controller* can be manually reset either by depressing the *"Low Voltage Reset"* button located on the *Electronic Controller* (use a thin, straight object to access the reset button through the small hole in the faceplate) or by turning ***OFF*** the *"Diesel"* switch on the Heater's *Interior Switch Panel* for approximately 30 seconds, then turning the switch back ***ON***.

4.5 Low Tank-Level Cutoff Indicator Light

This indicator light will illuminate RED when either the *120 VAC Electric Heating Element* and/or the *Diesel-Burner* have automatically shut down due to a low water and antifreeze solution level inside the Aqua-Hot's *Boiler Tank*; reference Figure 5. This fault will automatically reset when the low-level condition is corrected.

4.6 Heating Status Indicator Light

This indicator light will illuminate GREEN whenever the Aqua-Hot's *VDC/VAC Control Thermostat* is calling for heat, allowing the water and antifreeze solution in the Aqua-Hot's *Boiler Tank* to be heated by either the *Diesel-Burner* and/or the *120 VAC Electric Heating Element*; reference Figure 5. When this indicator light is off, no heat is being supplied to the Aqua-Hot's *Boiler Tank*. Please note that this light will only be active if either the "*Diesel"* and/or the "*Electric"* switch are turned ***ON***; reference Figure 4.

NOTE: The Aqua-Hot's *VDC/VAC Control Thermostat* will automatically activate the *Diesel-Burner* and/or the *120 VAC Electric Heating Element* **only** if the "*Diesel"* and/or the "*Electric"* switch is in the ***ON*** position. In order to heat the motorhome/domestic hot water, simply choose the desired heat source(s) and leave the switch(s) (i.e., "Diesel" and/or "Electric") ***ON***.

4.7 Engine Preheat Pump Indicator Light

This indicator light will illuminate GREEN whenever the *Engine Preheat Pump* is operating; reference Figures 1 and 5. Please note that this light will only be active if the "*Engine Preheat"* switch is ***ON*** in conjunction with either the "*Diesel"* and/or the "*Electric"* switch; reference Figure 4. If this indicator light illuminates RED, it indicates an electrical overload condition (i.e., a short) has occurred in this particular component's circuitry.

4.8 Pump #1 Indicator Light

This indicator light will illuminate GREEN whenever *Circulation Pump #1* is operating; reference Figures 1 and 5. Please note that this light will only be active if the *Aqua-Hot* is at normal operating temperature (i.e., between 160°F and 190°F) and *Heating Zone #5* is calling for heat; reference Appendix A. If this light illuminates RED, it indicates an electrical overload condition (i.e., a short) has occurred in this particular component's circuitry.

4.9 Pump #2 Indicator Light

This indicator light will illuminate GREEN whenever *Circulation Pump #2* is operating; reference Figures 1 and 5. Please note that this light will only be active if the *Aqua-Hot* is at normal operating temperature (i.e., between 160°F and 190°F) and if either *Heating Zones #2, #3, or #4* are calling for heat; reference Appendix A. If this light illuminates RED, it indicates an electrical overload condition (i.e., a short) has occurred in this particular component's circuitry.

4.10 Pump #3 Indicator Light

This indicator light will illuminate GREEN whenever *Circulation Pump #3* is operating; reference Figures 1 and 5. Please note that this light will only be active if the *Aqua-Hot* is at normal operating temperature (i.e., between 160°F and 190°F) and *Heating Zone #1* is calling for heat; reference Appendix A. If this light illuminates RED, it indicates an electrical overload condition (i.e., a short) has occurred in this particular component's circuitry.

4.11 Low Battery Voltage Fault Indicator Light

This indicator light will illuminate RED whenever the VDC voltage level is too low for the *Aqua-Hot* to operate properly; reference Figure 5. This fault must be manually reset after the voltage level has been restored to the VDC battery system; reference Section 4.4 for reset instructions.

4.12 Low Temp Cutoff Status Indicator Light

NOTE: This indicator light circuitry is not utilized on these *Aqua-Hot* models.

4.13 Diesel-Burner Status Indicator Light

This indicator light will illuminate GREEN whenever the Aqua-Hot's *Diesel-Burner* is operating and supplying heat to the Aqua-Hot's *Boiler Tank*; reference Figures 1 and 5. Please note that this light will only be active if the "*Diesel"* switch is turned ***ON***; reference Figure 4.

4.14 Overload Fault Indicator Light

This indicator light will illuminate RED (reference Figure 5) whenever one of the following conditions have occurred:

1 The *Aqua-Hot* is off due to an electrical overload (i.e., a short) in the main VDC power supply circuitry.

2 The *Aqua-Hot* is off due to a combination of high electrical VDC power loads and a high surface temperature of the *Electronic Controller*. The *Electronic Controller* will automatically reset once the electrical overload (i.e., a short) and/or the high heat condition is corrected.

Component 5.1 Component Overview Overview

1. Diesel-Burner Controller **10.** Heat Exchanger
2. Motor **11.** Combustion Chamber
3. Ignition Coil **12.** Exhaust Port
4. Clutch **13.** Flame Sensor
5. Combustion Air Blower **14.** Fuel Pump
6. Fuel Solenoid Valve **15.** Fuel Tubes (Supply / Return)
7. Electrode Boots **16.** Combustion Air Intake Port,
8. Ignition Electrodes with Adjustable Shutter
9. Fuel Nozzle

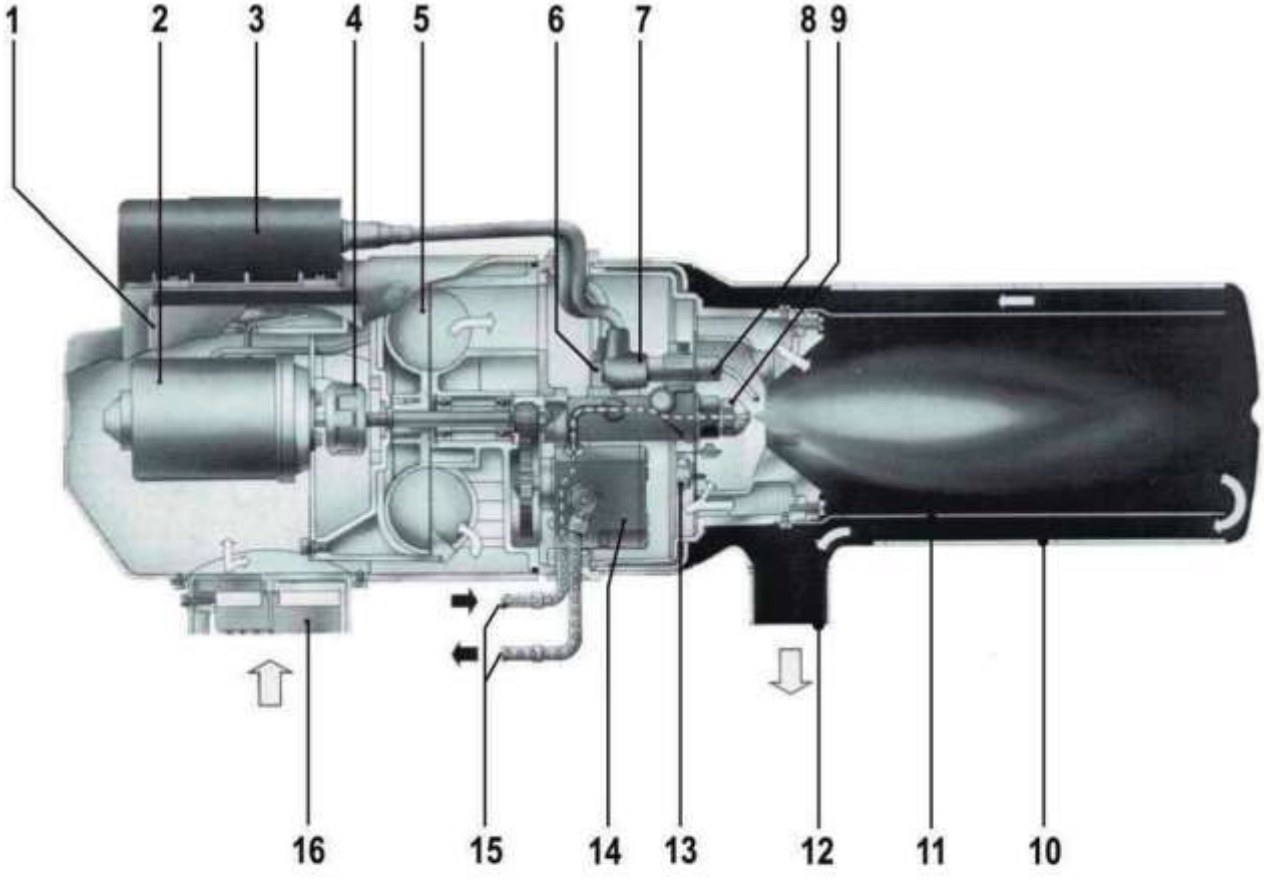


Figure 6

Operational 5.2 Operational Flow-Chart Flow-Chart

Operation sequence once the Aqua-Hot's ***Diesel*** switch is turned ***ON***.

NOTE:

The ***Diesel*** switch's ***Indicator Light*** will illuminate (reference Figure 4), while the ***Aqua-Hot Heating Status*** and ***Diesel-Burner Status*** lights illuminate on the ***Electronic Controller***; reference Figure 5.

The ***Motor (#2)***, which turns the ***Combustion Air Blower (#5)*** and drives the ***Fuel Pump (#14)***, will begin to operate.

NOTE:

If the Aqua-Hot's coolant temperature is approximately 190 (+/- 5) degrees Fahrenheit or higher, the Motor (#2) will not operate. Only when the coolant temperature has dropped below 160 (+/- 5) degrees Fahrenheit, and the VDC / VAC Control Thermostat (reference Figure 3) is calling for heat, will the Motor (#2) begin to operate.

After approximately 10 - 25 seconds, the **Fuel Solenoid Valve (#6)** opens and fuel is sprayed into the **Combustion Chamber (#11)** through the **Fuel Nozzle (#9)**.

Simultaneously, the ***Ignition Coil (#3)*** produces a high voltage spark across the ***Ignition Electrodes (#8)***, which ignites the incoming air-fuel mixture.

Once the ignited air-fuel mixture (FLAME) is observed by the ***Flame Sensor (#13)***, the ***Ignition Coil (#3)*** will automatically switch ***OFF***. The combustion process now continues to operate unassisted.

The combustion process will continue to operate in this manner until one of the following occurs:

A.) The ***VDC / VAC ControlThermostat*** (reference Figure 3), which senses coolant temperature, reaches the preset temperature of approximately 190 (+/- 5) degrees Fahrenheit.

NOTE:

If process "A" occurs, the ***Low Temp Cutoff Status***, ***Aqua-Hot Heating Status***, and ***Diesel-Burner Status*** lights on the ***Electronic Controller*** will go ***OFF***; reference Figure 5.

B.) The Aqua-Hot's ***Diesel*** switch is turned ***OFF***.

NOTE:

If process "B" occurs, the **Diesel** switch's **Indicator Light**, on the **Switch Panel** (reference Figure 4), will go ***OFF*** along with the **Heating Status** and **DieselBurner Status** lights on the **Electronic Controller**; reference Figure 5.

Once the heater switches ***OFF***, thermostatically or manually, the **Fuel Solenoid Valve (#6)**closes, which interrupts the supply of diesel fuel to the **Fuel Nozzle (#9)**.

The ***Motor (#2)*** will continue to run for approximately three (3) additional minutes. This process is refered to as the **purge-cycle**, which cools the heater's internal components and purges the ***Combustion Chamber (#11)*** of any residual exhaust gases.

NOTE:

When the Aqua-Hot's ***Diesel-Burner*** is switched ***OFF*** by the ***VDC / VAC Control Thermostat*** (reference Figure 3), the following process will take place:

1.) The ***Motor (#2)*** will shut off once the three (3) minute **purge-cycle** has expired.

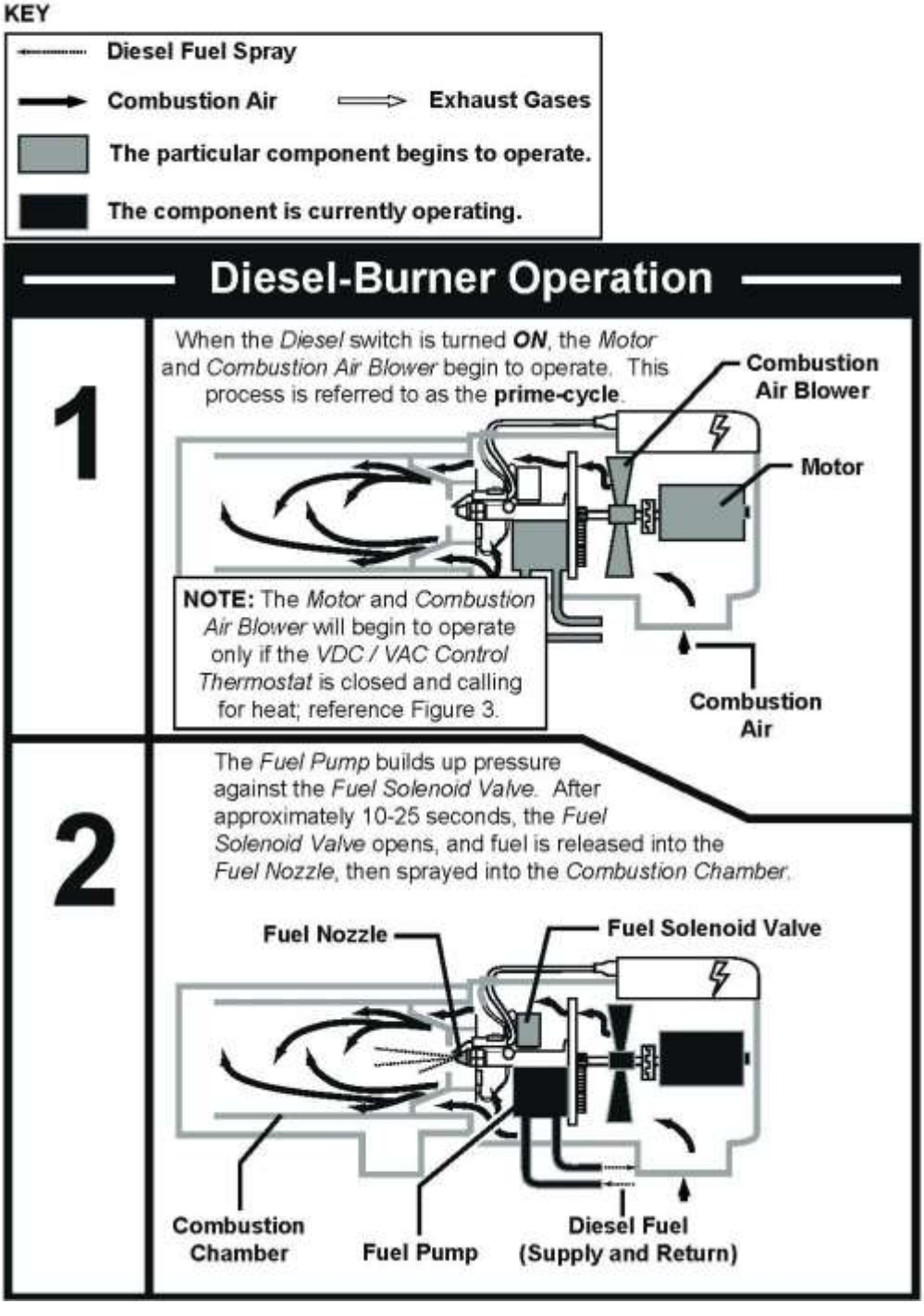
-THEN2.) The Aqua-Hot's ***Diesel-Burner*** will automatically turn back ***ON*** once the coolant reaches the preset temperature of approximately 160 (+/- 5) degrees Fahrenheit.

SUMMARY:

The Aqua-Hot's ***Diesel-Burner*** is operational anytime the operator moves the ***Diesel*** switch (reference Figure 4) to the ***ON*** position. The ***Diesel-Burner*** will then automatically maintain the coolant temperature in the Aqua-Hot's Boiler Tank without additional involvement from the operator.

Operational 5.3 Operational Sequence Sequence

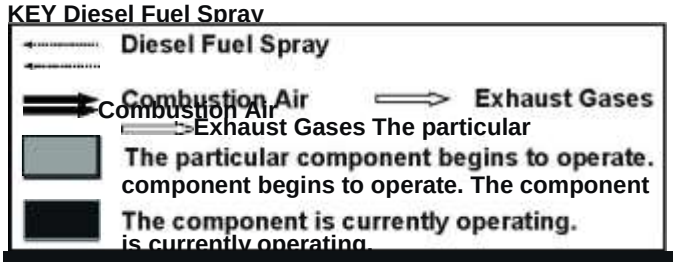
The following sequence illustrates how the Aqua-Hot's *Diesel-Burner* operates once it is activated. Also, if Diesel-Burner malfunctions are experienced, use the following sequence of operating events as a diagnostic tool to determine the point in the Diesel-Burner's operation that the malfunction occurs. Use the **"KEY"** provided to understand each symbol shown.


KEY
Diesel Fuel Spray
Combustion Air
Exhaust Gases
The particular component begins to operate.
The component is currently operating.
Diesel-Burner Operation
1
When the *Diesel* switch is turned **ON**, the *Motor* and *Combustion Air Blower* begin to operate. This process is referred to as the **prime-cycle**.
Combustion Air Blower
Motor
NOTE: The *Motor* and *Combustion Air Blower* will begin to operate only if the *VDC / VAC Control Thermostat* is closed and calling for heat; reference Figure 3.
Combustion Air
2
The *Fuel Pump* builds up pressure against the *Fuel Solenoid Valve*. After approximately 10-25 seconds, the *Fuel Solenoid Valve* opens, and fuel is released into the *Fuel Nozzle*, then sprayed into the *Combustion Chamber*.
Fuel Nozzle
Fuel Solenoid Valve
Combustion Chamber
Fuel Pump
Diesel Fuel (Supply and Return)

Operational 5.3 Operational Sequence Sequence,

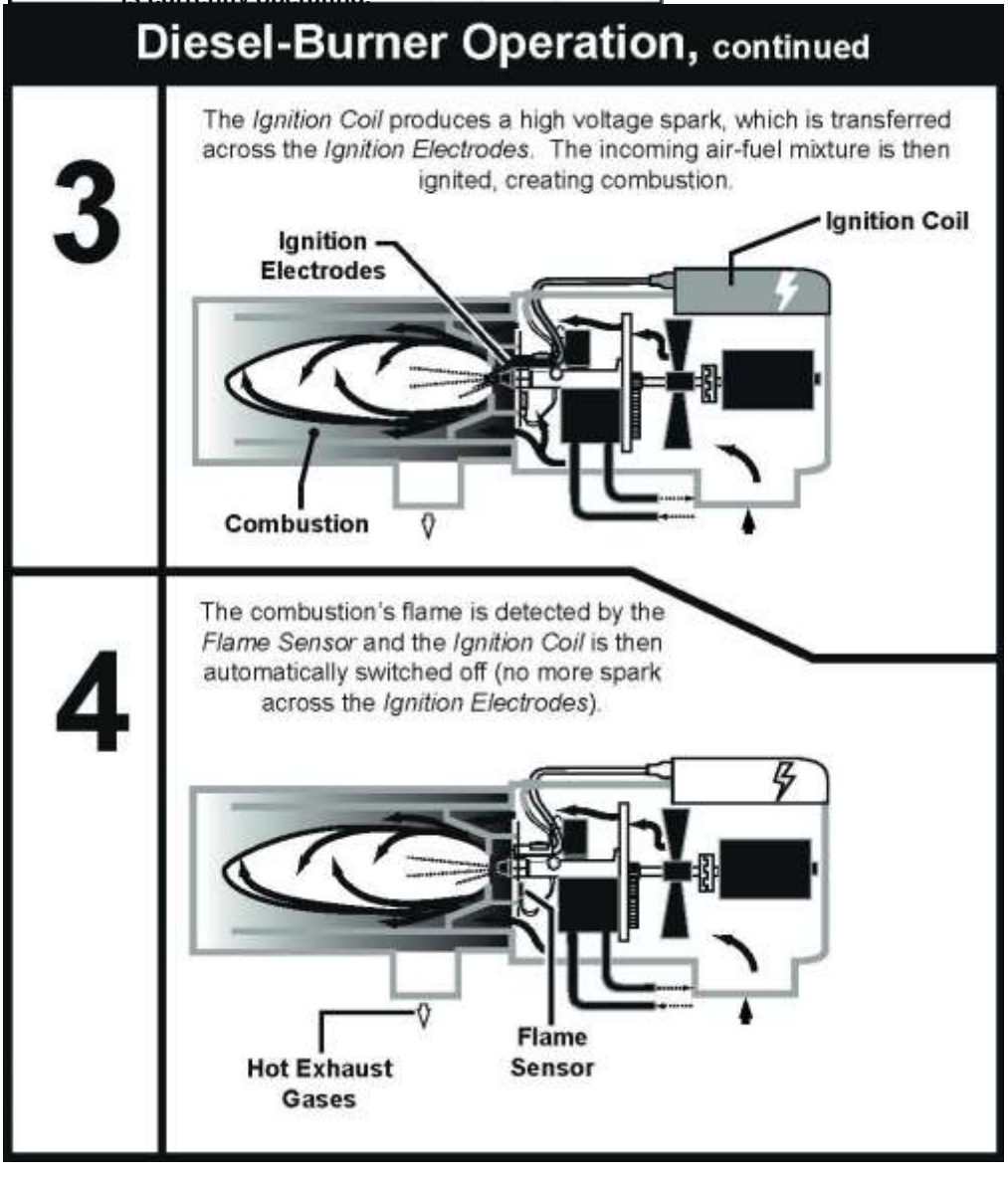
continued

KEY Diesel Fuel Spray



Combustion Air

Exhaust Gases The particular component begins to operate. The component is currently operating.


Diesel-Burner Operation, continued
3
The *Ignition Coil* produces a high voltage spark, which is transferred across the *Ignition Electrodes*. The incoming air-fuel mixture is then ignited, creating combustion.
Ignition Electrodes
Ignition Coil
Combustion
4
The combustion's flame is detected by the *Flame Sensor* and the *Ignition Coil* is then automatically switched off (no more spark across the *Ignition Electrodes*).
Hot Exhaust Gases
Flame Sensor

Operational 5.3 Operational Sequence Sequence,

continued

KEY

Diesel Fuel Spray

Combustion Air

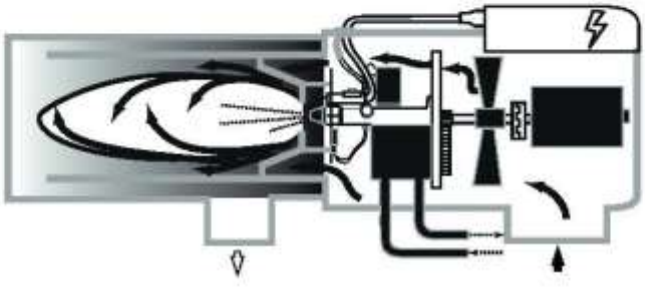
The particular component begins to operate.

The component is currently operating.

Diesel-Burner Operation, continued

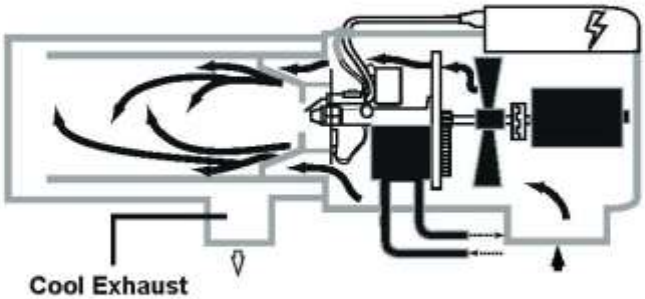
5

The *Diesel-Burner* will continue to produce heat in this manner until it is switched off either manually or by the *VDC / VAC Control Thermostat*, which occurs when the coolant temperature in the Aqua-Hot's *Boiler Tank* reaches 190 (+/- 5) degrees Fahrenheit.



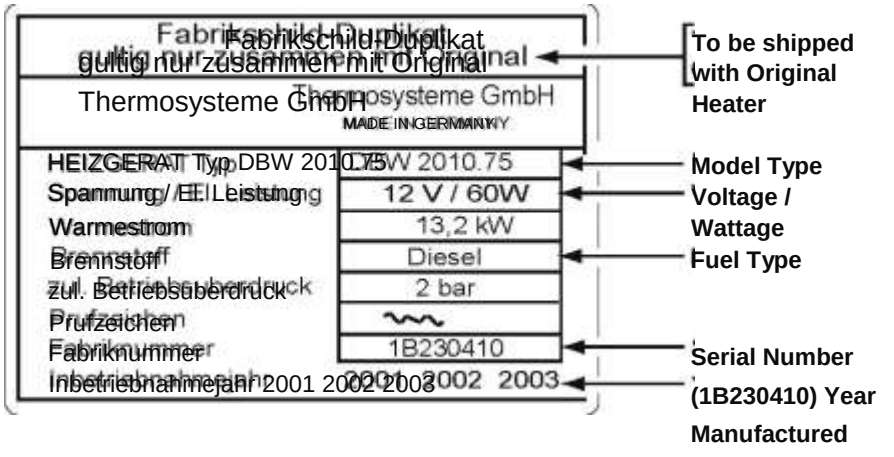
6

Once the *Diesel-Burner* has switched ***OFF***, the *Motor* and *Combustion Air Blower* will continue to operate for approximately 2-3 minutes. This process is referred to as the **purge-cycle**.



NOTE: Whenever the *Diesel-Burner* is switched off by the *VDC/VAC Control Thermostat*, it will automatically be reactivated once the Aqua-Hot Boiler Tank's coolant reaches the preset temperature of approximately 160 (+/-) 5 degrees Fahrenheit.

I.D. Plate 5.4 Identification Plate



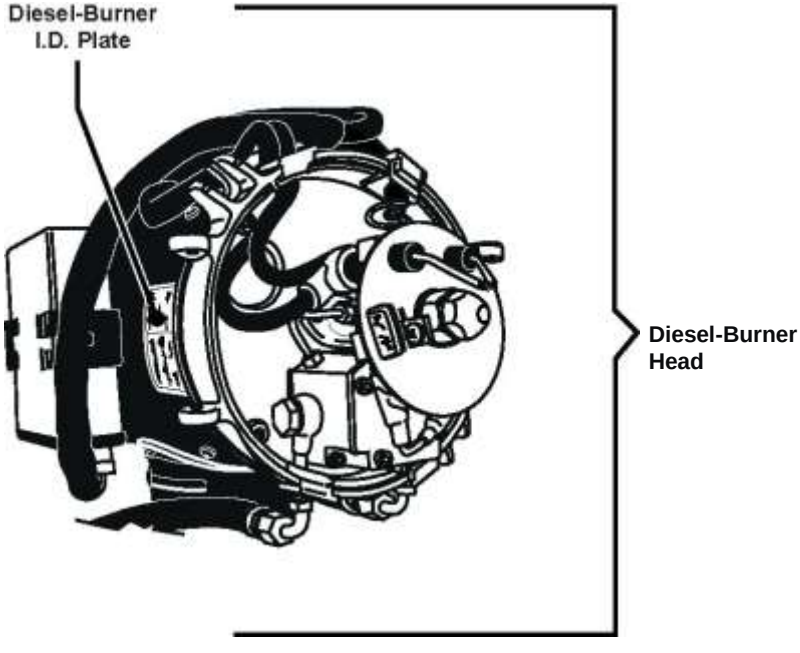


Figure 7

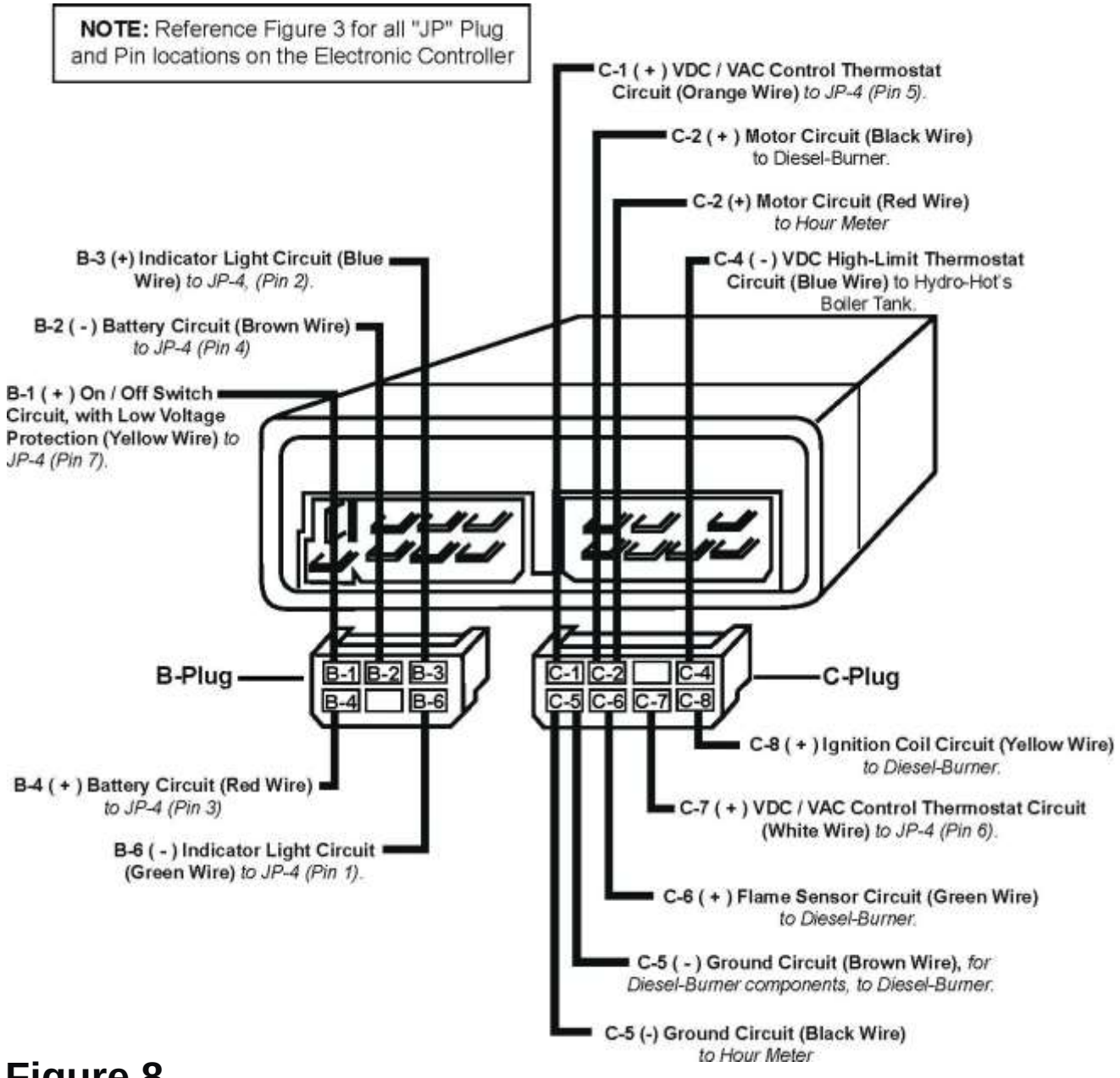

NOTE: Reference Figure 3 for all "JP" Plug and Pin locations on the Electronic Controller
C-1 (+) VDC / VAC Control Thermostat Circuit (Orange Wire) to JP-4 (Pin 5).
C-2 (+) Motor Circuit (Black Wire) to Diesel-Burner.
C-2 (+) Motor Circuit (Red Wire) to Hour Meter
C-4 (-) VDC High-Limit Thermostat Circuit (Blue Wire) to Hydro-Hot's Boiler Tank.
B-3 (+) Indicator Light Circuit (Blue Wire) to JP-4, (Pin 2).
B-2 (-) Battery Circuit (Brown Wire) to JP-4 (Pin 4)
B-1 (+) On / Off Switch Circuit, with Low Voltage Protection (Yellow Wire) to JP-4 (Pin 7).
B-Plug
B-1 B-2 B-3
B-4 B-6
C-Plug
C-1 C-2 C-4
C-5 C-6 C-7 C-8
C-8 (+) Ignition Coil Circuit (Yellow Wire) to Diesel-Burner.
C-7 (+) VDC / VAC Control Thermostat Circuit (White Wire) to JP-4 (Pin 6).
B-4 (+) Battery Circuit (Red Wire) to JP-4 (Pin 3)
B-6 (-) Indicator Light Circuit (Green Wire) to JP-4 (Pin 1).
C-6 (+) Flame Sensor Circuit (Green Wire) to Diesel-Burner.
C-5 (-) Ground Circuit (Brown Wire), for Diesel-Burner components, to Diesel-Burner.
C-5 (-) Ground Circuit (Black Wire) to Hour Meter

Figure 8

Troubleshooting

This Troubleshooting Section has been separated into various Aqua-Hot Troubleshooting Scenarios, which may be experienced by the heater. Each section listed below begins with the most probable cause and remedy and proceeds to the least probable cause and remedy. This concept has been put in place to expedite the troubleshooting process and pinpoint the problem quicker. However, if additional assistance is needed, please feel free to contact Vehicle Systems' Technical Support Department at 1-800-685-4298 or E-mail the issue to Vehicle Systems' Technical Support Department by going to www.vehiclesys.com and clicking on "Technical Support." Also, please review the following **"KEY"** prior to troubleshooting, as it may be helpful in understanding the abbreviations used.

KEY:

TS#: (i.e., TS1, TS2, ...) = Troubleshooting Scenario 1, Troubleshooting Scenario 2, ...

Q#: (i.e., Q1, Q2,....) = Question 1, Question 2, ...

A: = Answer

A: = Answer

TS#: (i.e., TS1, TS2, ...) = Troubleshooting Scenario 1, Troubleshooting Scenario 2, ... **Q#: (i.e., Q1, Q2,....) =** Question 1, Question 2, ...

After turning the *"Diesel"* switch *ON*: **Section** TS1 -The Aqua-Hot's *Diesel-Burner* fails to operate 7.1 TS2

-The Aqua-Hot's *Diesel-Burner* operates (3-minute prime cycle only),

but does not ignite 7.2 TS3 -The Aqua-Hot's *Diesel-Burner* ignites after several starting attempts 7.3 TS4

-The Aqua-Hot's *Exhaust System* sputters 7.4 TS5 -The Aqua-Hot's *Exhaust System* produces white smoke

after ignition 7.5 TS6 -The Aqua-Hot's *Exhaust System* produces black smoke after ignition 7.6

Other troubleshooting issues:

TS7 -The Aqua-Hot is at operating temperature, but an *Interior and/or Fresh Water Tank Heating Zone* is not producing heat 7.7

TS8 -The Aqua-Hot is at operating temperature, however the fans of an *Interior and/or Fresh Water Heat Exchanger* fans are not operating 7.8

TS9 -The Aqua-Hot is at operating temperature, but the *Domestic Hot Water System* is not producing hot water 7.9

After turning the Electric switch ON:

TS10 -The Aqua-Hot's *120 VAC Electric Heating Element* does not operate (i.e., lack of hot water and/or interior heat) 7.10

After turning the Engine Preheat switch ON:

TS11 -The Aqua-Hot's *Engine Preheat System* does not preheat the engine 7.11

Section 7.1 After turning the "*Diesel*" switch *ON*: TS1 : The Aqua-Hot's *Diesel-Burner* fails to operate.

NOTE (7.1-A): In order to perform the following checks, it is necessary to locate the Aqua-Hot's *Electronic Controller* and *Switch Panel*; reference "Illustration 7.1-1."

Q1 **Q1 : Is the Electronic Controller's *Low Tank-Level Cutoff* light illuminated ?**

If YES: **Perform each of the following procedures, as necessary, until the problem is resolved.**

If NO: **Proceed to Q2.**

WARNING: DO NOT remove the Aqua-Hot's *Radiator Cap* when the heater is at maximum operating temperature; reference Figure 1. Hot coolant can be present, and serious personal injury may result.

I. Check the coolant level in the Aqua-Hot's *Expansion Tank* and the *Boiler Tank*, if necessary.

A: If coolant level is satisfactory: **Continue troubleshooting.**

If coolant level is low: **Add coolant and attempt heater restart.**

II. Check for continuity at the *Float Switch*; reference Figure 1 and Appendix A.

A: If continuity exists: **Continue troubleshooting.**

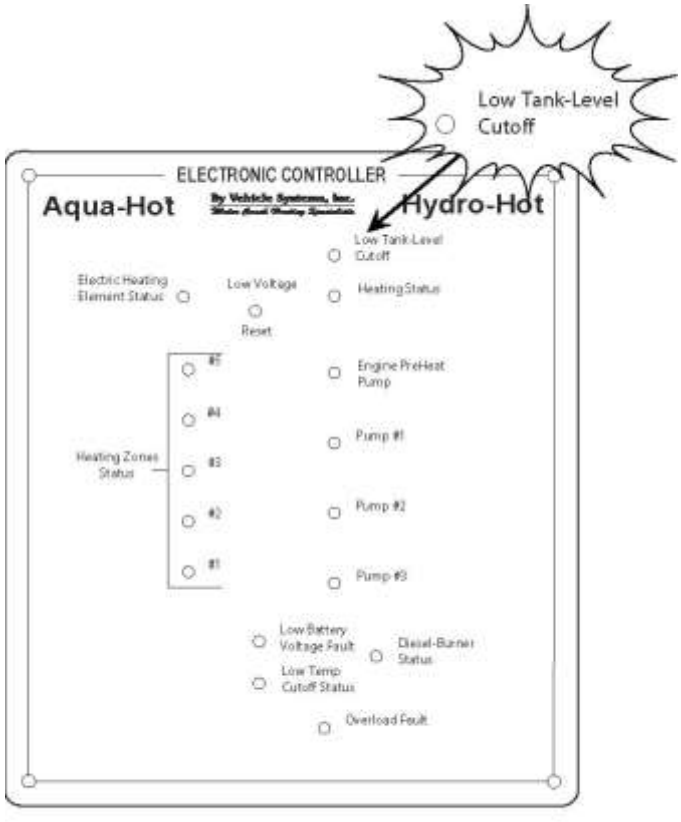
If continuity does not exist: **The *Float Switch* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.**

III. Remove the Electronic Controller's *Faceplate* and use a jumper wire to make a connection from *Pin 15* to *Pin 16* on the *JP-3 Plug*; reference Appendix A.

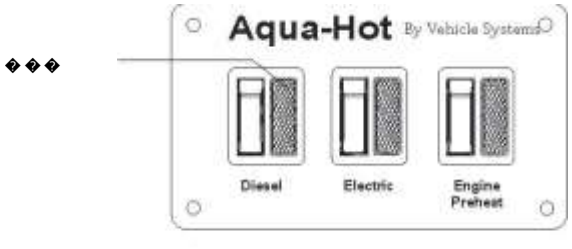
Does the *Emergency Cutoff* light go off? (continued on next page)

Section 7.1, continued

Illustration 7.1-1



Electronic Controller Faceplate



Switch Panel

Section 7.1, continued

A: If YES: **Check the *JP-3 Plug* for loose wire connections and/or harness damage**

If NO:
The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Q2: Is the Electronic Controller's *Low Battery Voltage Fault* light illuminated?

A: If YES: **Perform each of the following procedures, as necessary, until the problem is resolved.**

If NO:
Proceed to Q3.

I. Remove the Electronic Controller's *Face-plate*. Check the DC battery voltage at the supply batteries and at the Electronic Controller's *Battery Connections*; reference Appendix A. Both voltage readings should be between 11.5 and 14.0 volts.

A: If the voltage level is within specs: **Continue Troubleshooting.**

If the voltage level is out of specs:
Recharge and/or replace batteries.

II. Reset the *Low Voltage Reset* (button) on the *Electronic Controller* (this can be accom-plished either by using a thin, straight object to access the reset button through the small hole in the *Faceplate* or by turning ***OFF*** the "Diesel" switch on the Heater's Interior Switch Panel for approximately 30 seconds, then turning the switch back ***ON***). Continue to read the voltage level at the Electronic Controller's *Battery Connections*, then, turn the "*Diesel"* switch ***ON***.

Under load, is the voltage level within 0.5 volts of the supply battery's voltage?

A: If YES: **Reference "NOTE (7.1-B)."**

If NO:
Load-test the supply batteries, (continued in the next column)

Section 7.1, continued

inspect battery wiring for damage and/or loose connections, and ensure that all of the Aqua-Hot's electrical motors are operating normally when under load.

NOTE (7.1-B): If, after testing and correcting the battery system, the *Low Battery Voltage Fault* indicator light continues to illuminate, and/or the *Low Voltage Reset* (button) will not reset, the *Electronic Controller* must be replaced. Please contact the Technical Support Department at **1-800-685-4298** for assistance.

Q3: Is the Electronic Controller's *Diesel-Burner Status* light illuminated?

A: If NO: **Perform each of the following procedures, as necessary, until the problem is resolved.**

If YES:
Proceed to Q5.

I. Remove the Electronic Controller's *Face-plate*. Use a jumper wire to make a connection from the *Diesel (O)* to the *Diesel (I)* on the *JP-2 Plug*; reference Appendix A.

Does the *Diesel-Burner Status* light illuminate?

A: If YES: **The "*Diesel"* switch must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance. Attempt heater restart.**

If NO:
Continue Troubleshooting.

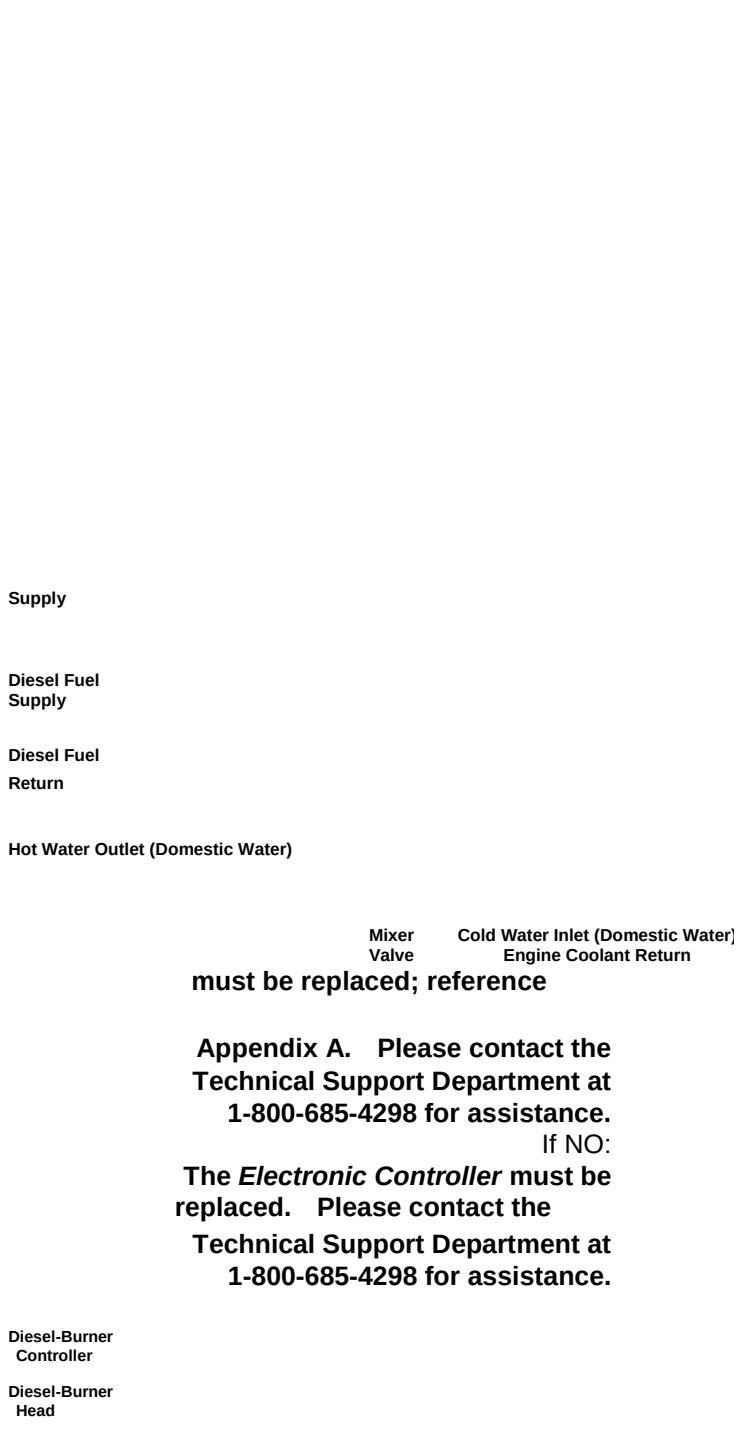
II. Turn the "*Diesel"* switch ***OFF*** (also, make sure the "*Electric"* switch is ***OFF***). Use a jumper wire to make a connection from *Pin 13* to *Pin 14* on the *JP-3 Plug*; reference Appendix A. With the jumper wire in place, turn the "*Diesel"* switch ***ON***.

Does the *Diesel-Burner* ignite and the *Diesel-Burner Status* light illuminate?

A: If YES: **The VDC/VAC *Control Thermostat* (continued on next page)**

Section 7.1,
continued

Illustration 7.1-2



NOTE (7.1-C): If no problems were discovered up to this point, the problem most likely lies within the *Diesel-Burner Head*. However, prior to troubleshooting the *Diesel-Burner Head*, please review the **"Operational Flow-Chart" in Section 5.2**, the **"Operational Sequence" in Section 5.3**, and the **"Function"** section for each of the Diesel-Burner *Components*; reference Sections 8.3 through 8.11. This information may help determine at what point the *Diesel-Burner* fails to operate.

Q4 : Is the Diesel-Burner's Motor operating?
Quick Check: Listen at the heater for the Diesel-Burner's *Motor* to operate or check for output air at the heater's exhaust pipe.

A: If the *Motor* does not seem to be operating: **Reference Section 8.3 and perform the Motor's "Component Test."** If the *Motor* is operating: **Continue troubleshooting.**

Q5 : Is the *Diesel-Burner Controller* functioning properly?

I. In order to determine if the *Diesel-Burner Controller* is functioning properly, reference Section 8.11 and perform the Controller's "Component Test."

A: If the *Diesel-Burner Controller* is not functioning properly: **The *Controller* must be replaced; reference Section 8.11 for replacement instructions.** If the *Controller* is functioning properly: **Reference "NOTE (7.1-D)."**

must be replaced; reference

Appendix A. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If NO:

The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Section 7.1, continued

NOTE (7.1-D): If the *Aqua-Hot* still does not operate after performing all of the listed checks, contact the Technical Support Department at **1-800-685-4298** for additional assistance.

Section 7.2

After turning the *"Diesel"* switch ON:

TS2: The Aqua-Hot's *Diesel-Burner* operates (3-minute prime cycle only) but does not ignite.

NOTES (7.2-A):

A. It is ideal to have the Aqua-Hot's *Fuel Filter* replaced yearly; reference Section 8.1. A plugged *Fuel Filter* will not allow the *Diesel-Burner* to operate properly. Also, before proceeding to the following procedures, be sure to check that the vehicle's fuel tank has a sufficient level of fuel.

B. In order to perform some of the following procedures, it may be necessary to detach the *Diesel-Burner Head* from the *Aqua-Hot*. Therefore, be sure to reference Section 8.2 for detaching and reattaching instructions.

Q1 Q1 : Has the Aqua-Hot's *VDC High-Limit Thermostat* tripped?

A: Locate the *VDC High-Limit Thermostat* and check for continuity; reference Figure 1 and Appendix B.

Is continuity present?

NOTE (7.2-B): Although the *Diesel-Burner* is now functioning, be sure to perform the following steps until the cause for overheating has been discovered and corrected. Failure to do so could result in additional overheating incidents.

restart.

NOTE (7.2-B): Although the *Diesel-Burner* is now functioning, be sure to perform the following steps until the cause for overheating has been discovered and corrected. Failure to do so could result in additional overheating incidents.

Section 7.2, continued

II. Turn the *"Diesel"* switch ***ON*** and allow the *Aqua-Hot* to reach operating temperature (i.e., until the *Diesel-Burner* cycles ***OFF***). Locate both the *VDC High-Limit Thermostat* and the *VAC/VDC Control Thermostat* and check them for continuity; reference Figure 1 and Appendix B.

A: If there is no continuity at the *VDC High-Limit Thermostat*, but there is continuity at the *VAC/VDC Control Thermostat:*

The *VAC/VDC Control Thermostat* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If there is continuity at the *VDC High-Limit Thermostat*, but none at the *VAC/VDC Control Thermostat*:

The overheat condition may have been caused by another faulty component, and no further troubleshooting is necessary; reference "NOTE (7.2-C)" and please contact the Technical Support Department at 1-800-685-4298 for additional assistance.

NOTE (7.2-C): If the *VDC High-Limit Thermostat* continues to trip, and no overheating problems were discovered (i.e., faulty *VAC/VDC Control Thermostat* or *Diesel-Burner Controller*), it may be that the *VDC High-Limit Thermostat* is not operating properly and may need to be replaced.

Q2 Q2 : Is the *Diesel-Burner Fuel Nozzle* functioning properly?

A: In order to determine if the *Fuel Nozzle* is functioning properly, reference Section 8.6 and perform the Fuel Nozzle's "Component Test."

A: If the *Fuel Nozzle* is not functioning properly:

The *Fuel Nozzle* must be replaced; reference Section 8.6 for replacement instructions.

If the *Fuel Nozzle* is functioning properly:

Continue troubleshooting.

Section 7.2,
continued

Q3 : Is the Diesel-Burner's *Fuel SolenoidValve* functioning properly?

I. In order to determine if the *Fuel Solenoid Valve* is functioning properly, reference Section 8.7 and perform the Fuel Solenoid Valve's "Component Test."

A: If the *Fuel SolenoidValve* is not function- ing properly: **The *Fuel Solenoid Valve* must be replaced; reference Section 8.7 for replacement instructions.** If the *Fuel Solenoid Valve* is functioning properly: **Continue troubleshooting.**

Q4 : Is the *Diesel-BurnerController* function-ing properly?

I. In order to determine if the *Controller* is functioning properly, reference Section 8.11 and perform the Controller's "Component Test."

A: If the *Controller* is not functioning properly: **The *Controller* must be replaced; reference Section 8.11 for replacement instructions.** If the *Controller* is functioning properly: **Continue troubleshooting.**

Q5 : Is the Diesel-Burner's *Ignition Coil* functioning properly?

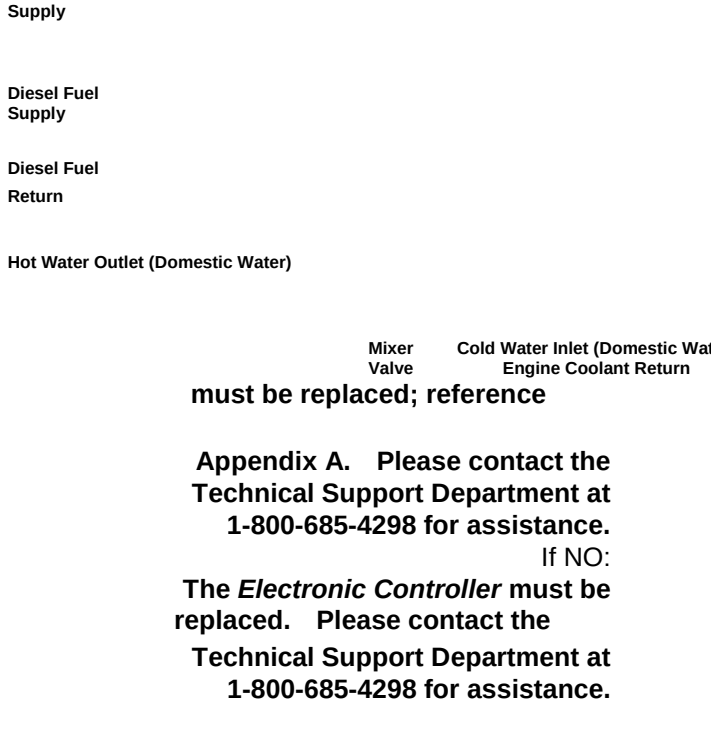
I. In order to determine if the *Ignition Coil* is functioning properly, reference Section 8.10 and perform the Ignition Coil's "Component Test."

A: If the *Ignition Coil* is not functioning properly: **The *Ignition Coil* must be replaced; reference Section 8.10 for replacement instructions.** If the *Ignition Coil* is functioning properly: **Continue troubleshooting.**

Q6 : Are the Diesel-Burner's *Ignition Electrodes* in good condition and properly adjusted? (continued on next page)

Section 7.2,
continued

Illustration 7.2-1


Supply
Diesel Fuel Supply
Diesel Fuel Return
Hot Water Outlet (Domestic Water)
Mixer Valve
Cold Water Inlet (Domestic Wat
Engine Coolant Return
must be replaced; reference
Appendix A. Please contact the Technical Support Department at 1-800-685-4298 for assistance.
If NO:
The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.
Diesel-Burner Controller
Diesel-Burner Head

Section 7.2, continued

I. In order to determine if the I*gnition Elec-trodes* are in good condition and properly adjusted, reference Section 8.5.

A: If the *Ignition Electrodes* are in poor condition:

The *Ignition Electrodes* must be replaced; reference Section 8.5 for replacement instructions.

If the *Ignition Electrodes* are not properly adjusted:

Adjust the *Ignition Electrodes*; reference Section 8.5 for adjust-ment instructions.

If the *Ignition Electrodes* are both in good condition and properly adjusted:

Continue troubleshooting.

Q7 : Is the Diesel-Burner's *Flame Sensor* functioning properly?

In order to determine if the *Flame Sensor* is functioning properly, reference Section 8.4 and perform the Flame Sensor's "Component Test."

A: If the Flame Sensor is not functioning properly:

The *Flame Sensor* must be replaced; reference Section 8.4 for replacement instructions.

If the *Flame Sensor* is functioning properly:

Continue troubleshooting.

Q8 : Is the Diesel-Burner's *Fuel Pump* functioning properly?

In order to determine if the *Fuel Pump* is functioning properly, reference Section 8.8 and perform the Fuel Pump's "Component Test."

A: If the *Fuel Pump* is not functioning properly:

The *Fuel Pump* must be replaced; reference Section 8.8 for replace-ment instructions.

If the *Fuel Pump* is functioning properly:

Reference "NOTE (7.2-D)."

Section 7.2, continued

NOTE (7.2-D): If the *Aqua-Hot* still does not ignite after performing all of the listed checks, contact the Technical Support Department at **1-800-685-4298** for additional assistance.

Section 7.3

After turning the *"Diesel"* switch *ON*:

TS3: The Aqua-Hot's *Diesel-Burner* ignites after several starting attempts.

NOTES (7.3-A):

A. It is ideal to have the Aqua-Hot's *Fuel Filter* replaced yearly; reference Section 8.1. A plugged *Fuel Filter* will not allow the *Diesel-Burner* to operate properly. Also, before proceeding to the following procedures, be sure to check that the vehicle' fuel tank has a sufficient level of fuel

B. In order to perform the following procedures, it is necessary to detach the *Diesel-Burner Head* from the *Aqua-Hot*. Be sure to refer-ence Section 8.2 for detaching and reattach-ing instructions.

Q1 : Is the Diesel-Burner's Fuel Nozzle functioning properly?

In order to determine if the *Fuel Nozzle* is functioning properly, reference Section 8.6 and perform the Fuel Nozzle's "Component Test."

A: If the *Fuel Nozzle* is not functioning properly:

The *Fuel Nozzle* must be replaced; reference Section 8.6 for replacement instructions.

If the *Fuel Nozzle* is functioning properly:

Continue troubleshooting.

Section 7.3,
continued

Q2 : Is the Diesel-Burner's *Flame Sensor* functioning properly?

I. In order to determine if the *Flame Sensor* is functioning properly, reference Section 8.4 and perform the Flame Sensor's "Compo- nent Test."

A: If the *Flame Sensor* is not functioning

Q3 : Are the Diesel-Burner's *Ignition Electrodes* in good condition and properly adjusted?

I. In order to determine if the *Ignition Electrodes* are in good condition and properly adjusted, reference Section 8.5.

A: If the *Ignition Electrodes* are in poor condition: **The *Ignition Electrodes* must be replaced; reference Section 8.5 for replacement instructions.** If the *Ignition Electrodes* are not properly adjusted: **Adjust the *Ignition Electrodes*; reference Section 8.5 for adjust- ment instructions.** If the *Ignition Electrodes* are both in good condition and properly adjusted: **Continue troubleshooting.**

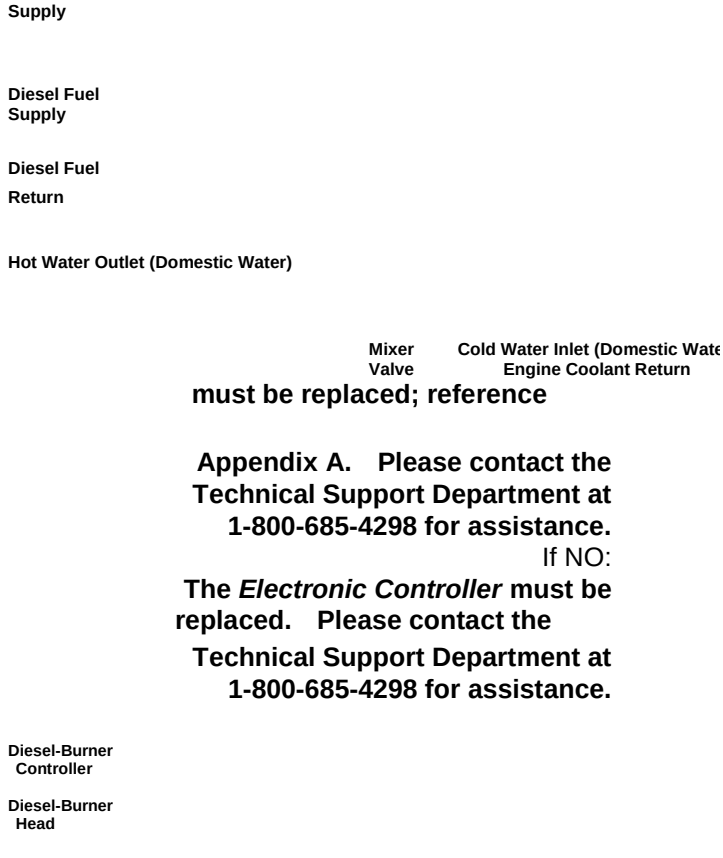
Q4 : Is the Diesel-Burner's *Fuel Pump* functioning properly?

I. In order to determine if the *Fuel Pump* is functioning properly, reference Section 8.8 and perform the Fuel Pump's "Component Test."

A: If the *Fuel Pump* is not functioning properly: **The *Fuel Pump* must be replaced; reference Section 8.8 for replace- ment instructions.** If the *Fuel Pump* is functioning properly: **Continue troubleshooting.**

Section 7.3,
continued

Illustration 7.3-1



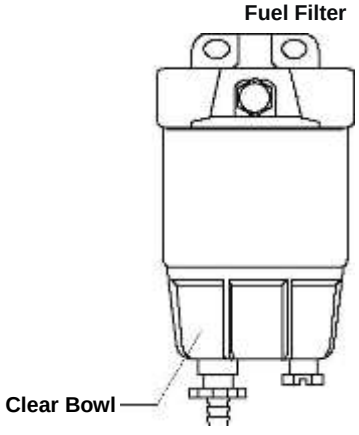
must be replaced; reference Appendix A. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

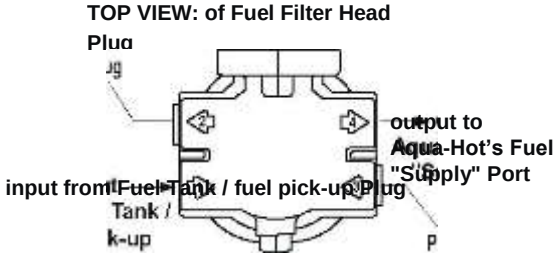
If NO:

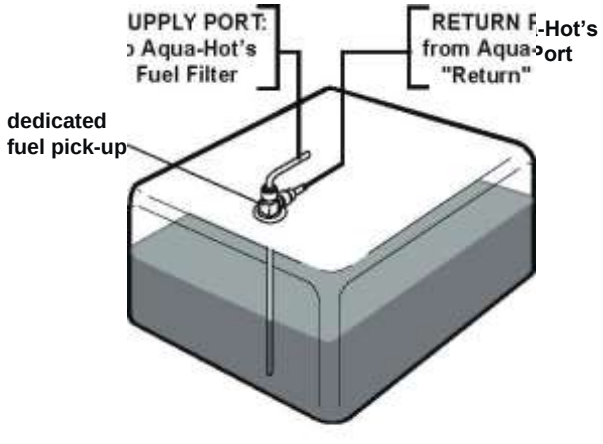
The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Section 7.3, continued

Illustration 7.3-2







Fuel Pick-up Pipe Illustration

Section 7.3, continued

Q5 : Is the Diesel-Burner's *Fuel Supply System* functioning properly?

Quick Check: With the *Diesel-Burner* ignited, listen for constant sputtering from the Aqua-Hot's exhaust system.

A: If constant sputtering exists: **Continue troubleshooting.**

If constant sputtering does not exist: **Proceed to Q6.**

NOTE (7.3-B): Inspect the clear bowl of the *Fuel Filter* for water. If water exists, be sure to purge the Aqua-Hot's entire fuel system prior to replacing the *Fuel Filter*. Attempt heater restart; reference "Illustration 7.3-2."

I. Clamp off and remove the Aqua-Hot's *Fuel Return Line*; reference Figure 1. Now attach a short piece of fuel line to the Aqua-Hot's *Fuel Return Port* and place the other end in a container of diesel fuel. Remove the clamp and ensure that the fuel line is com-pletely submersed in the fuel, then, turn the *"Diesel"* switch ***ON***.

Are air bubbles visible in the container of fuel when the *Diesel-Burner* is operating?

A: If air bubbles are not visible: **Proceed to Q6.**

If air bubbles are visible:

You will need to inspect the fuel system (supply side) for air leaks. Therefore, be sure to perform the inspections listed below until the air leak has been detected:

1. Inspect the fuel system (supply side) from the vehicle's fuel tank to the *Diesel-Burner*. Inspect the fuel system for loose fuel connections at the *Aqua-Hot* and *Diesel-Burner*, as well as the vehicle's fuel tank. Tighten, if necessary. Also, check that all Fuel Filter Head fittings are securely tightened; reference "NOTE (7.3-C)."

Section 7.3,
continued

NOTE (7.3-C): Be sure to check that each fitting at the *Fuel Filter Head* contains thread sealant. A fitting without thread sealant could result in an air leak. Be sure to clamp off both fuel lines at the filter head prior to any fitting removal. If fittings are removed and reinstalled, be sure to remove the fuel line clamps prior to attempting a heater restart. Failure to do so could result in serious damage to the Diesel-Burner's *Fuel Pump*.

(7.3-C): Be sure to check that each fitting at the *Fuel Filter Head* contains thread sealant. A fitting without thread sealant could result in an air leak. Be sure to clamp off both fuel lines at the filter head prior to any fitting removal. If fittings are removed and reinstalled, be sure to remove the fuel line clamps prior to attempting a heater restart. Failure to do so could result in serious damage to the Diesel-Burner's *Fuel Pump*.

2. **Once the potential air leak has been discovered and corrected, reattach the Aqua-Hot's *Fuel Return Line* and attempt heater restart.**
   Does the Aqua-Hot's exhaust system still sputter?

   If the exhaust system is still sputtering:

   Continue performing air leak inspections until all air leaks have discovered and corrected.

Q6 : Is the Diesel-Burner's *Controller* functioning properly?

In order to determine if the *Controller* is functioning properly, reference Section 8.11 and perform the *Controller's* "Component Test."

A: If the *Controller* is not functioning properly:

The *Controller* must be replaced; reference Section 8.11 for replacement instructions.

If the *Controller* is functioning properly:

Continue troubleshooting.

Q7 : Is the Diesel-Burner's *Ignition Coil* functioning properly?

In order to determine if the *Ignition Coil* is functioning properly, reference Section 8.10 and perform the Ignition Coil's "Component Test."

A: If the *Ignition Coil* is not functioning properly:

The *Ignition Coil* must be replaced; reference Section 8.10 for replacement instructions.
(continued in the next column)

Section 7.3,
continued

If the *Ignition Coil* is functioning properly:

Reference "NOTE (7.3-D)."

NOTE (7.3-D): If the *Aqua-Hot* still does not ignite after several starting attempts and all of the listed checks were performed, contact the Technical Support Department at **1-800-685-4298** for additional assistance.

NOTE (7.3-D): If the *Aqua-Hot* still does not ignite after several starting attempts and all of the listed checks were performed, contact the Technical Support Department at **1-800-685-4298** for additional assistance.

Illustration 7.3-3

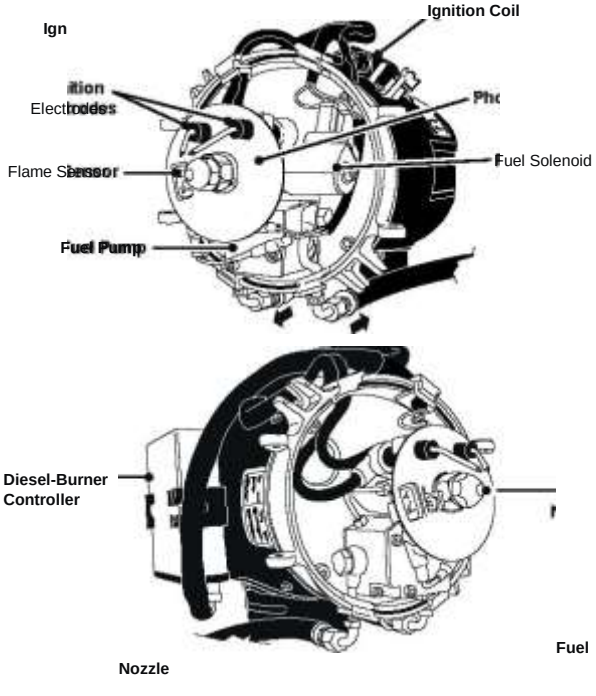


Illustration 7.4-1

Illustration 7.4-1

After turning the *"Diesel"* switch *ON*:

TS4: The Aqua-Hot's exhaust system sputters.

NOTE (7.4-A): Before advancing to the following procedures, be sure to check that the vehicle's fuel tank has a sufficient level of fuel.

NOTE (7.4-A): Before advancing to the following procedures, be sure to check that the vehicle's fuel tank has a sufficient level of fuel.

Q1 **Q1: Is the Diesel-Burner's *Fuel Nozzle* functioning properly?**

In order to determine if the *Fuel Nozzle* is functioning properly, reference Section 8.6 and perform the Fuel Nozzle's "Component Test."

A: If the *Fuel Nozzle* is not functioning properly:

The *Fuel Nozzle* must be replaced; reference Section 8.6 for replacement instructions.

If the *Fuel Nozzle* is functioning properly:

Continue troubleshooting.

Q2 **Q2 : Is the Diesel-Burner's *Fuel Supply System* functioning properly?**

Quick Check: With the *Diesel-Burner* ignited, listen for constant sputtering from the Aqua-Hot's exhaust system.

A: If constant sputtering exists:

Continue troubleshooting.

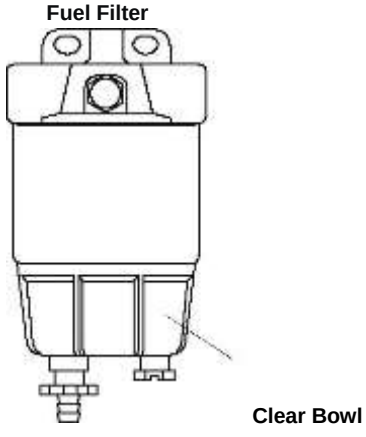
NOTE (7.4-B): Inspect the clear bowl of the *Fuel Filter* for water. If water exists, be sure to purge the Aqua-Hot's entire fuel system prior to replacing the *Fuel Filter*. Attempt heater restart; reference "Illustration 7.4-1."

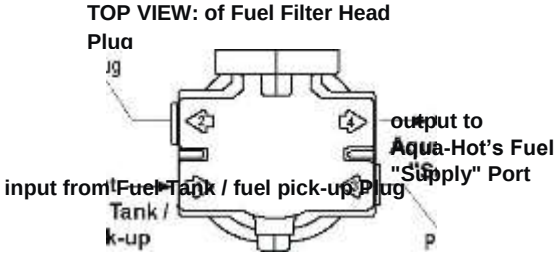
NOTE (7.4-B): Inspect the clear bowl of the *Fuel Filter* for water. If water exists, be sure to purge the Aqua-Hot's entire fuel system prior to replacing the *Fuel Filter*. Attempt heater restart, reference "Illustration 7.4-1."

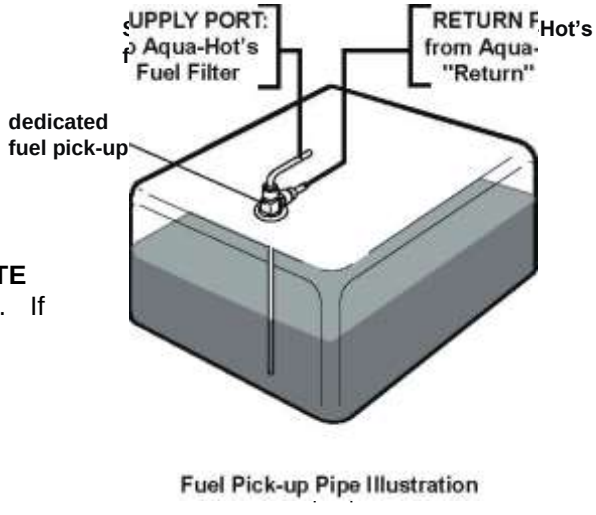
1. Clamp off and remove the Aqua-Hot's *Fuel Return Line*; reference Figure 1. Now attach a short piece of fuel line to the Aqua-Hot's *Fuel Return Port* and place the other end in a container of diesel fuel. Remove the clamp and ensure that the fuel line is com-pletely submersed in the fuel, then, turn the *"Diesel"* switch ***ON***.

Are air bubbles visible in the container of fuel when the *Diesel-Burner* is operating?

(continued on next page)







Fuel Pick-up Pipe Illustration

Section 7.4, continued

A: If air bubbles are not visible:
Reference "NOTE (7.4-D)."

If air bubbles are visible:

You will need to inspect the fuel system (supply side) for air leaks. Therefore, be sure to perform the inspections listed below until the air leak has been detected:

1. Inspect the fuel system (supply side) from the vehicle's fuel tank to the *Diesel-Burner*. Inspect the fuel system for loose fuel connections at the *Aqua-Hot* and *Diesel-Burner*, as well as the vehicle's fuel tank. Tighten, if necessary. Also, check that all Fuel Filter Head fittings are securely tightened; reference "NOTE (7.4-C)."

NOTE (7.4-C): Be sure to check that each fitting at the *Fuel Filter Head* contains thread sealant. A fitting without thread sealant could result in an air leak. Be sure to clamp off both fuel lines at the filter head prior to any fitting removal. If fittings are removed and reinstalled, be sure to remove both clamps prior to attempting a heater restart. Failure to do so could result in serious damage to the Diesel-Burner's *Fuel Pump*.

NOTE (7.4-C): Be sure to check that each fitting at the *Fuel Filter Head* contains thread sealant. A fitting without thread sealant could result in an air leak. Be sure to clamp off both fuel lines at the filter head prior to any fitting removal. If fittings are removed and reinstalled, be sure to remove both clamps prior to attempting a heater restart. Failure to do so could result in serious damage to the Diesel-Burner's *Fuel Pump*.

2. Once the potential air leak has been discovered and corrected, reattach the *Aqua-Hot's Fuel Return Line* and attempt heater restart. Does the Aqua-Hot's exhaust system still sputter?

If the exhaust system is still sputtering:

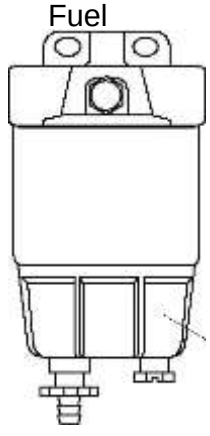
Continue performing air leak inspections until all air leaks have been discovered and corrected.

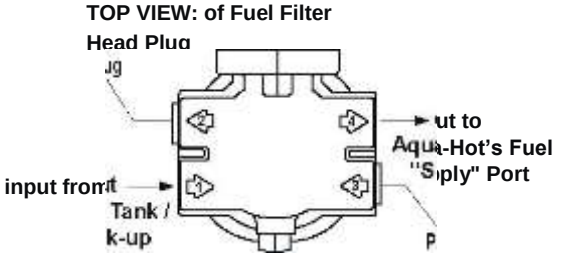
NOTE (7.4-D): If the Aqua-Hot's exhaust system still sputters after performing all of the listed checks, contact the Technical Support Department at **1-800-685-4298** for additional assistance.

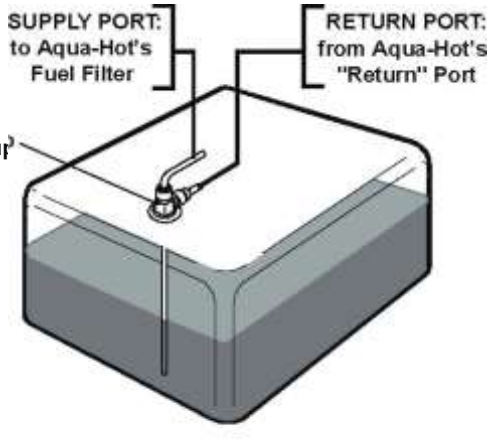
NOTE (7.4-D): If the Aqua-Hot's exhaust system still sputters after performing all of the listed checks, contact the Technical Support Department at **1-800685-4298** for additional assistance.

Section 7.4, continued

Illustration 7.4-2







Fuel Pick-up Pipe Illustration

Supply

Cover

Boiler Tank
Drain Valve

Diesel Fuel
Supply

Diesel-Burner
Controller

Diesel Fuel
Return

Pressure-Relief
Valve

Hot Water Outlet (Domestic Water)

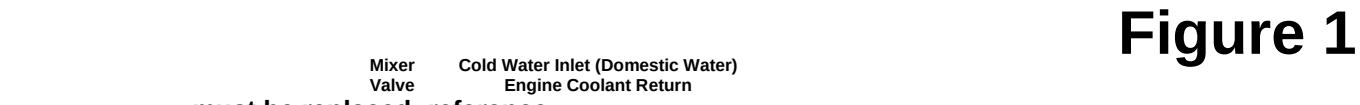


Figure 1

must be replaced; reference

Appendix A. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If NO:

The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Diesel-Burner
Controller

Diesel-Burner
Head

Ignition Coil

Ignition Electrodes

Photo Disc

Fuel Solenoid

Flame Sensor

Fuel Pump

Diesel-Burner
Controller

Fuel
Nozzle

Diesel-Burner
Controller

Diesel-Burner
Head

Ignition Coil

Ignition
Electrodes

Photo Disc

Fuel Solenoid

Flame Sensor

Section 7.5, continued

A: If constant white smoke exists: **Continue troubleshooting.**

NOTE (7.5-B): Inspect the clear bowl of the *Fuel Filter* for water. If water exists, be sure to purge the Aqua-Hot's entire fuel system prior to replacing the *Fuel Filter*. Attempt heater restart; reference "Illustration 7.5-2."

I. Clamp off and remove the Aqua-Hot's *Fuel Return Line*; reference Figure 1. Now attach a short piece of fuel line to the Aqua-Hot's *Fuel Return Port* and place the other end in a container of diesel fuel. Remove the clamp and ensure that the fuel line is com-pletely submersed in the fuel, then, turn the *"Diesel"* switch ***ON***.

Are air bubbles visible in the container of fuel when the *Diesel-Burner* is operating?

A: If air bubbles are not visible: **Proceed to Q6.**

If air bubbles are visible:

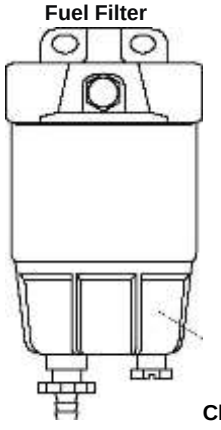
You will need to inspect the fuel system (supply side) for air leaks. Therefore, be sure to perform the inspections listed below until the air leak has been detected:

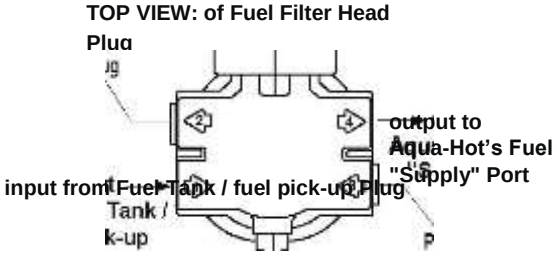
1. Inspect the fuel system (supply side) from the vehicle's fuel tank to the *Diesel-Burner*. Inspect the fuel system for loose fuel connections at the *Aqua-Hot* and *Diesel-Burner*, as well as the vehicle's fuel tank. Tighten, if necessary. Also, check that all Fuel Filter Head fittings are securely tightened; reference "NOTE (7.5-C)."

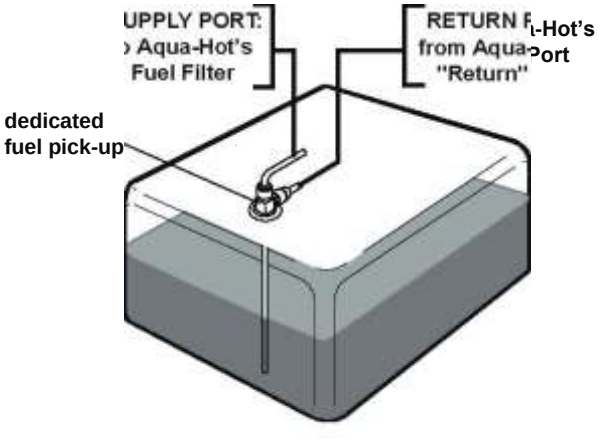
NOTE (7.5-C): Be sure to check that each fitting at the *Fuel Filter Head* contains thread sealant. A fitting without thread sealant could result in an air leak. Be sure to clamp off both fuel lines at the filter head prior to any fitting removal. If fittings are removed and reinstalled, be sure to remove both clamps prior to attempting a heater restart. Failure to do so could result in serious damage to the Diesel-Burner's *Fuel Pump*.

Section 7.5, continued

Illustration 7.5-2







Fuel Pick-up Pipe Illustration

Section 7.5, continued

2. Once the potential air leak has been discovered and corrected, reattach the Aqua-Hot's *Fuel Return Line* and attempt heater restart. Does the Aqua-Hot's exhaust system still sputter?

If the exhaust system is still sputtering:
Continue performing the air leak inspection until all air leaks have been discovered and corrected.

NOTE (7.5-D): If the Aqua-Hot's exhaust system still produces white smoke after performing all of the listed checks, contact the Technical Support Department at **1-800-685-4298** for additional assistance.

Section 7.6

After turning the *"Diesel"* switch *ON*:

TS6: The Aqua-Hot's exhaust system produces black smoke after ignition.

NOTE (7.6-A): In order to perform the following checks, it is necessary to locate the Aqua-Hot's Electronic Controller and Switch Panel; reference "Illustration 7.6-1."

Q1: Is the Electronic Controller's *Low Battery Voltage Fault* light illuminated?

A: If YES: **Perform each of the following procedures, as necessary, until the problem is resolved.**

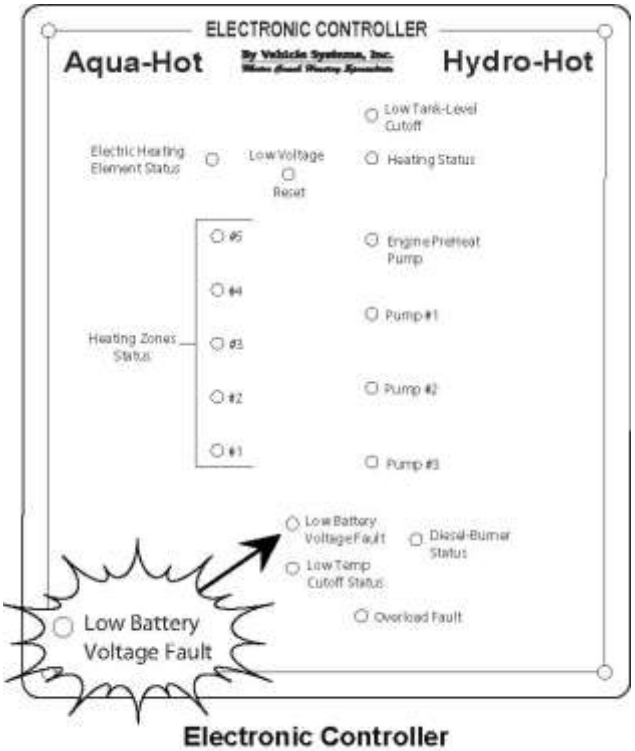
If NO:
Proceed to Q2.

I. Remove the Electronic Controller's *Face - plate*. Check the DC battery voltage level at the supply batteries and at the Electronic Controller's *Battery Connections*; reference Appendix A. Both voltage readings should be between 11.5 and 14.0 volts.

A: If the voltage level is within specs: **Continue troubleshooting.**
If the voltage level is out of specs: **Recharge and/or replace batter-ies, if necessary.**

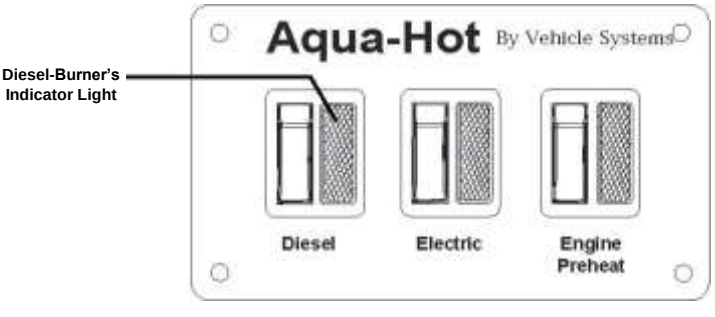
Section 7.6, continued

Illustration 7.6-1



Electronic Controller Faceplate

Q1 : Is the Electronic Controller's *Low Battery Voltage Fault* light illuminated?



Section 7.6,
continued

II. Reset the *Low Voltage Reset* (button) on the *Electronic Controller* (this can be accom- plished either by using a thin, straight object to access the reset button through the small hole in the Faceplate or by turning ***OFF*** the *"Diesel"* switch on the Heater's Interior Switch Panel for approximately 30 seconds, then turning the switch back ***ON***). Continue to read the voltage level at the Electronic Controller's *Battery Connections* and then turn the *"Diesel"* switch ***ON***.

NOTE (7.6-B): If, after testing and correcting the battery system, the *Low Battery Voltage Fault* indicator light continues to illuminate, and/or if the *Low Voltage Reset* (button) will not reset, the *Electronic Controller* must be replaced. Please contact the Technical Support Department at **1-800-6854298** for assistance.

NOTE (7.6-C): In order to perform some of the following procedures, it may be necessary to detach the *Diesel-Burner Head* from the *Aqua-Hot*. Therefore, be sure to reference Section 8.2 for detaching and reattaching instructions.

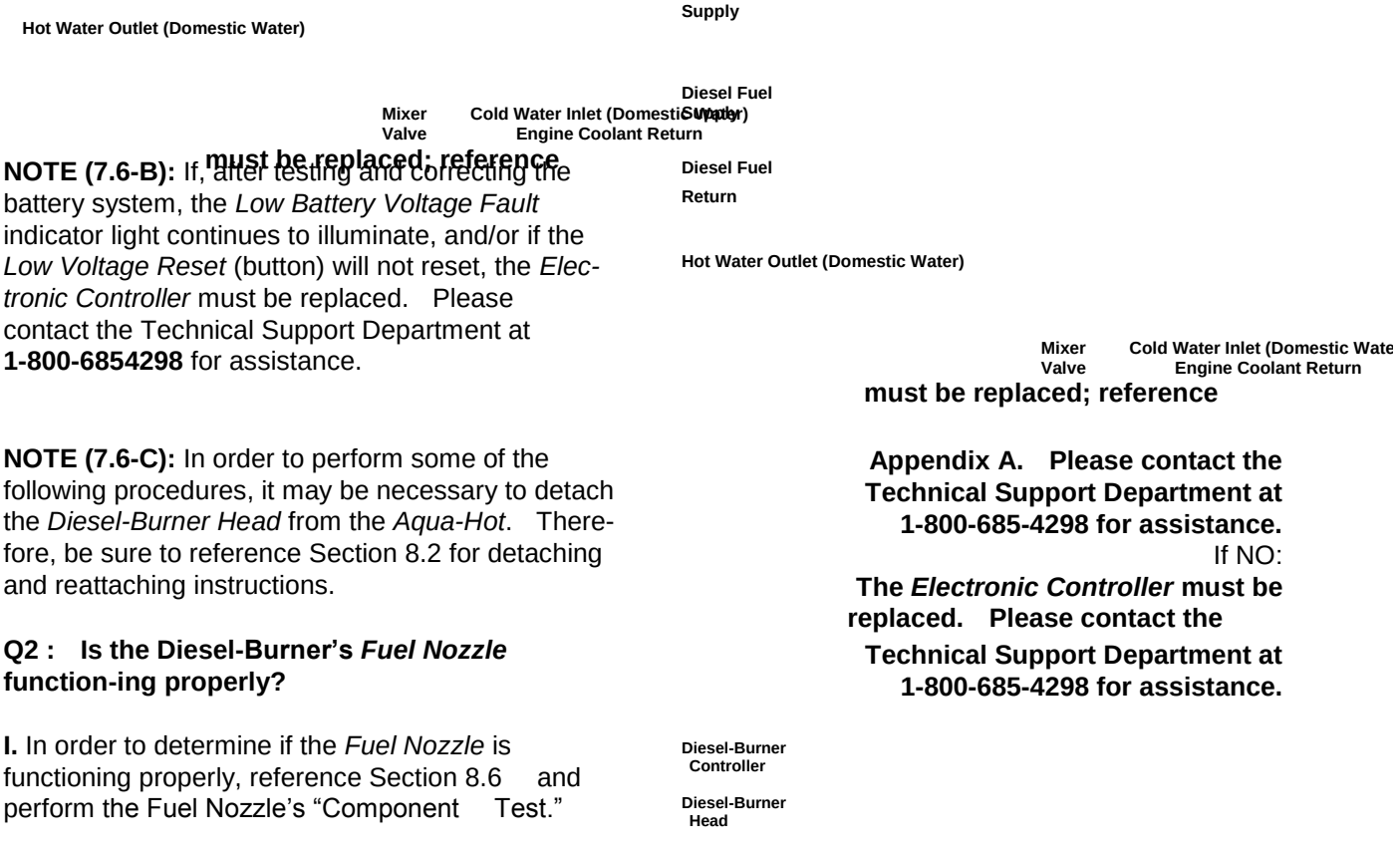
Q2 : Is the Diesel-Burner's *Fuel Nozzle* function-ing properly?

I. In order to determine if the *Fuel Nozzle* is functioning properly, reference Section 8.6 and perform the Fuel Nozzle's "Component Test."

A: If the *Fuel Nozzle* is not functioning properly: **The *Fuel Nozzle* must be replaced; reference Section 8.6 for replacement instructions. (continued on next page)**

Section 7.6,
continued

Illustration 7.6-1



Appendix A. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If NO:

The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Section 7.6,

continued If the *Fuel Nozzle* is functioning properly:

Continue troubleshooting.

Q3 : Is the Diesel-Burner's *Motor* operating at the proper RPM speed?

A: In order to determine if the *Motor* is operating properly, reference Section 8.3 and perform the Motor's "RPM Test."

A: If the *Motor* is not operating at the proper RPM:

The *Motor* must be replaced; reference Section 8.3 for replace-ment instructions.

If the *Motor* is operating at the proper RPM:

Continue troubleshooting.

Q4 : Is the Diesel-Burner's *Combustion Air Intake* adjusted properly?

A: See the "NOTE" below.

NOTE (7.6-D): In order to determine if the Diesel-Burner's *Combustion Air Intake* is adjusted properly, a CO_2 Gas-Analyzer will be required; reference "Illustration 7.6-3." Also, reference Section 11 for the Bacharach Fyrite CO_2 Analyzer's part number information, if necessary.

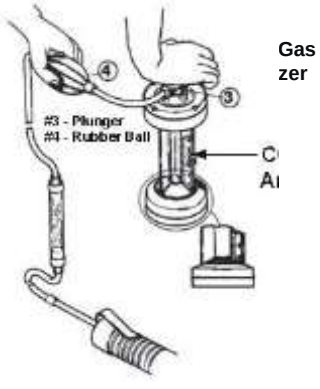
I. When using the Bacharach Fyrite CO_2 Analyzer, turn the *"Diesel"* switch ***ON*** and allow the *Diesel-Burner* to ignite and operate for approximately 2 minutes. Then perform the following procedures:

1 **Place the small end of the CO_2 Analyzer's suction hose into the Aqua-Hot's *Exhaust Pipe*.**

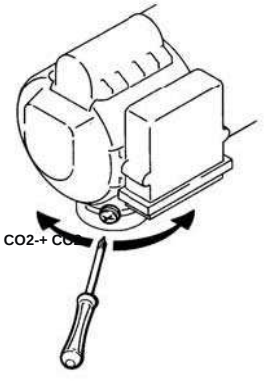
2 **Place the round plunger connection of the suction hose on the CO_2 Analyzer's "Plunger." Press down on the suction hose with the palm of your hand until the CO_2 Analyzer's "Plunger" is fully compressed. This will allow a sample of the Aqua-Hot's exhaust to enter the CO_2 Analyzer; reference "Illustration 7.6-3."**

Section 7.6, continued

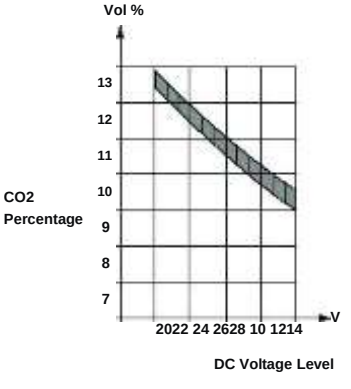
Illustration 7.6-3



Gas zer



Combustion Air Intake Adjustment



CO_2 -Value Chart

Section 7.6,
continued

1 **Pump the rubber ball 18 time**
2 **Release the suction hose fro**
the CO_2 Analyzer's plunger.
3 **Turn the CO_2 Analyzer upsi**
down to allow the fluid to advance to
the top, then, turn the Analyzer right
side up again. Perform this procedur
twice.
4 **Place the CO Analyzer on a**
flat surface and read the CO_2
level.

7. The CO_2 level should be between 10.5 and 11.5 percent (at a nominal 12 volts-DC). If the CO_2 level is not within the specs, an adjustment of the Diesel-Burner's *Combustion Air Intake* will be necessary; reference "Illustration 7.6-3." Once the proper CO_2 adjustment has been made, be sure to tighten the adjustment screw.

NOTE (7.6-E): In temporary high altitude situations (less available oxygen) the CO_2 will rise by 0.3% CO_2 per 1,000 feet of elevation (e.g., a *Diesel-Burner* adjusted at sea level should register approximately a 1.5% higher CO_2 reading when in Denver, Colorado (5,000 above sea level)). If permanently residing in a high altitude area, be sure to properly adjust the *Diesel-Burner* so that it operates within the 10.5% - 11.5% CO_2 range.

Section 7.6,
continued **NOTES (7.6-F):** If the proper CO value

NOTES (7.6-F): If the proper CO_2 value cannot be obtained, perform each of the following inspections, as necessary, until the cause has been detected:

A. Check the rubber *Grommets* on the top and bottom of the *Diesel-Burner Head's* cast-aluminum *Blower Casing* to ensure they are securely in place.

B. Check the *Diesel-Burner Head* for proper alignment (torque specification = approximately 20-40 in.lbs.); reference Section 8.2.

C. Check to ensure that the Diesel-Burner's *Fuel Pump* is producing the proper pressure. In order to determine if the *Fuel Pump* is producing the proper pressure, reference Section 8.8 and perform the Fuel Pump's "Fuel Pressure Adjustment Check."

D. Check and reset the *Combustion Air Blower* gap, if applicable. In order to determine if the *Combustion Air Blower's* gap is set properly, reference Section 8.9 and perform Steps 1-6 and 11-17 of the Bearings "Replacement Procedure."

E. Reference "NOTE (7.6-F)."

NOTE (7.6-G): If the Aqua-Hot's exhaust system still produces black smoke after performing all of the listed checks, contact the Technical Support Department at **1-800-685-4298** for additional assistance.

NOTE (7.6-G): If the Aqua-Hot's exhaust system still produces black smoke after performing all of the listed checks, contact the Technical Support Department at **1-800-685-4298** for additional assistance.

Section 7.7

After turning the *"Diesel"* switch *ON*:

TS7: The *Aqua-Hot* is at operating temperature, but an *Interior* and/or *Fresh Water Tank Heating Zone* is not producing heat.

Q1 : Is the particular Heating Loop's *Circulation Pump* operating?

Quick Check -Remove the Aqua-Hot's *Access Cover* and determine if the problem *Heat Exchanger(s)* is plumbed with *Circula-tion Pump #1*, *Circulation Pump #2*, or *Circulation Pump #3*; reference Figure 1 and "Appendix B." Once the particular *Circulation Pump* has been isolated, locate and activate the *Room Thermostat* for that particular heating zone. View the Circulation Pump's *Motor* through the clear, plastic cover to check for operation.

Is the *Circulation Pump* operating/rotating?

A: If YES: **Check the particular Heating Loop's plumbing system for kinks and/or any other types of flow restrictions.**

If NO:

Perform each of the following procedures, as necessary, until the problem is resolved:

1 **Locate the *Electronic Control-ler* and remove the *Faceplate*.**

2 **Locate the Electronic Controller's *JP-3 Plug* and insert the probes of a DC voltmeter into the particular Circulation Pump's *Pin* loca-tions; reference Appendix A:**

Circulation Pump #1
Pins 6(-) and 5(+)

Circulation Pump #2
Pins 4(-) and 3(+)

Circulation Pump #3
Pins 2(-) and 1(+)

Section 7.7, continued

Observe the DC voltage on the voltmeter.

Does a nominal 12 Volt-DC voltage reading register on the voltmeter?

A: If YES: **The *Circulation Pump* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.**

If NO:

The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Illustration 7.8-1

After turning the *"Diesel"* switch *ON*:

TS8: The *Aqua-Hot* is at operating temperature; however, the *Interior* and/or *Fresh Water Tank Heat Exchanger* fans are not operating.

Q1 Is the *Tank Sensor Pin Jumper* on the *Electronic Controller* properly installed?

Q1 : Remove the *Faceplate* from the *Electronic Controller*, allowing the Electronic Controller's *Printed Circuit Board* to be exposed. Locate the **"TANK SEN"** Pins located on the bottom right-side of the Electronic Controller's *Printed Circuit Board*; reference "Illustration 7.8-1."

Is the *Pin Jumper* properly installed with the *Pin Jumper* covering both pins in order to provide continuity?

A: If YES: **Continue troubleshooting.**

If NO:

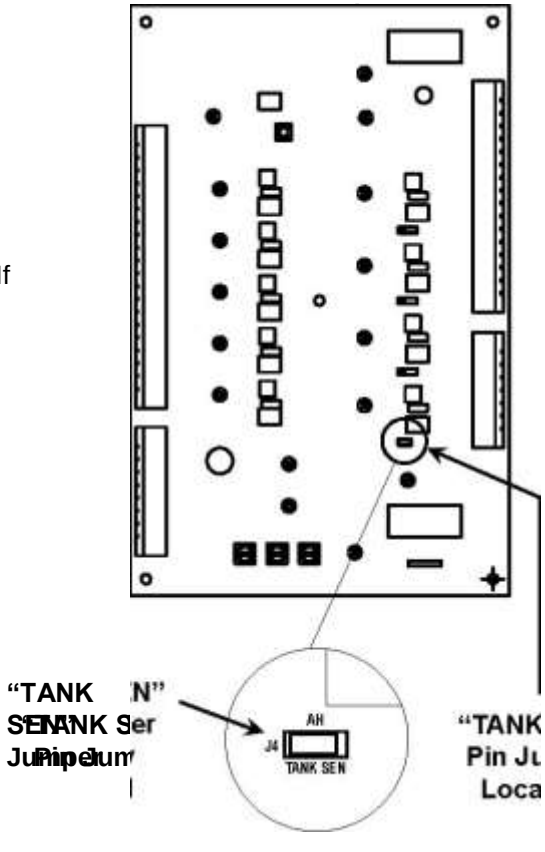
Reseat the *Pin Jumper* on both pins.

NOTE: If reseating the *Pin Jumper* does not correct the non-functioning Heat Exchanger Fan failure, the *Electronic Controller* may need to be replaced. Please contact the Technical Support Department at **1-800-685-4298** for assistance.

NOTE: If reseating the *Pin Jumper* does not correct the non-functioning Heat Exchanger Fan failure, the *Electronic Controller* may need to be replaced. Please contact the Technical Support Department at **1-800-685-4298** for assistance.

Electronic Controller Faceplate

Electronic Controller Printed Circuit



"TANK SEN" Pin Jumper Location

Section 7.9

After turning the *"Diesel"* switch *ON*:

TS9: The *Aqua-Hot* is at operating temperature, but the domestic hot water system is not producing hot water.

Q1 : Is the Aqua-Hot's *Tempering Valve* properly set?

Quick Check: The *Tempering Valve* should be preset on the valve's number "**3**" setting; reference "Illustration 7.9-1."

A: If YES: **Continue troubleshooting.**

If NO:

Adjust the *Tempering Valve* to the number "3" setting and retest the domestic hot water system.

Q2 : Is the

NOTE (7.9-A): This Aqua-Hot product utilizes an FDA approved GRAS Propylene Glycol (P.G.) antifreeze and water *heating solution*. This P.G. based *heating solution* utilizes a Boiler type antifreeze, which is Generally Recognized as Safe ("GRAS") by the FDA. A **50/50 heating solution** of P.G. antifreeze and water is recommended to provide the best overall domestic hot water and interior heating performance (50% P.G. antifreeze and 50% water).

Quick Check: Utilizing an antifreeze *refractometer* (reference Section 11 for special tools information), test the concentration of the antifreeze and water *heating solution*. An antifreeze concentra-tion higher than 50% will cause poor domestic hot water performance.

A: If YES: **Continue troubleshooting.**

If NO:

Adjust the antifreeze and water *heating solution* accordingly until the proper concentration is obtained.

Q3 : Is the shower's *flow rate* (i.e., Gallons per Minute), of domestic hot water, too high? Reference "NOTE (7.9-B)."

Section 7.9, continued

NOTE (7.9-B): Domestic hot water *flow rates* exceeding 1.5 Gallons per Minute (GPM) can contribute to poor domestic hot water performance. However, this is directly dependent upon the temperature of the incoming domestic cold water to the Aqua-Hot's domestic hot water system. Therefore, please be sure to reference the informational graph, contained within Section 7.9, regarding the theoretical performance of the Aqua-Hot's domestic hot water system.

Quick Check: Utilizing a one-gallon Graduated Cylinder (or an equivalent one-gallon container), measure the time it takes the shower to produce one gallon of hot water, then utilize the chart below to determine the shower's GPM *flow rate*:

15 seconds = 4.0 GPM
20 seconds = 3.0 GPM
25 seconds = 2.4 GPM
30 seconds = 2.0 GPM
35 seconds = 1.7 GPM
40 seconds = 1.5 GPM
45 seconds = 1.3 GPM
50 seconds = 1.2 GPM
55 seconds = 1.1 GPM
60 seconds = 1.0 GPM

A: If YES: **Please contact the Technical Support Department at 1-800-685-4298 for additional assistance.**

If NO:

If the shower's *flow rate* is less than 1.5 GPM and the Aqua-Hot still fails to produce hot water, please contact the Technical Support Department at 1-800-685-4298 for additional assistance.

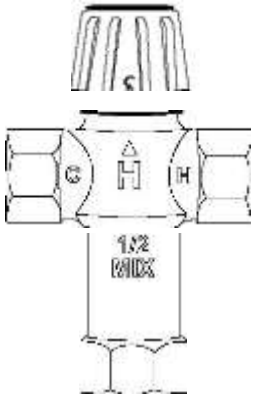
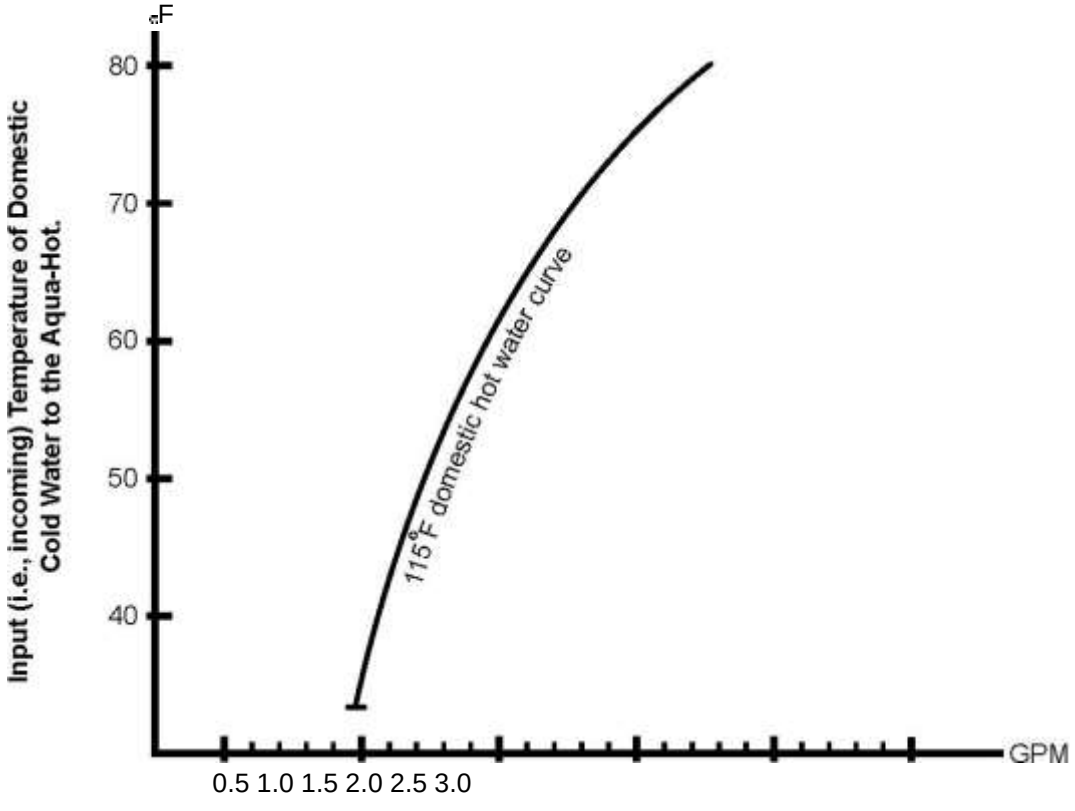


Illustration 7.9-1

Tempering Valve correctly set to "3."

Section 7.9,
continued

The chart below is a graphical representation of how the Aqua-Hot's Domestic Hot Water System theoretically performs under varying incoming domestic cold water temperatures. Because each Aqua-Hot has a performance tolerance, this graphic should be used as a general guideline and not as actual domestic hot water performance data.



(GPM - Gallons per Minute)

The estimated domestic cold water flow rate required to maintain an approximate 115°F domestic hot water output temperature.

Notes of Interest

When water is heated to...
156 degrees - Hot water causes a third-degree burn in one second
149 degrees - Hot water causes a third-degree burn in two seconds 133 degrees - Hot water causes a third-degree burn quickly 115-120 degrees - General purpose temperatures 107 - 109 degrees - Average "Hot-Tub" temperatures 105 degrees - Average "Shower" temperature

Section 7.10

After turning the *"Electric"* switch *ON*:

TS10: The Aqua-Hot's *120 VAC Electric Heating Element* does not operate (i.e., lack of hot water and/or interior heat).

Q1 Q1 : Is the Electronic

NOTE (7.10-A): The temperature of the Aqua-Hot's *Boiler Tank* must be below 160°F prior to performing this test.

***Element Status* light illuminated? (Reference Figure 5.)**

A: If YES: **Perform each of the following procedures, as necessary, until the problem is resolved.**

1 **Locate the *Electronic Controller* and remove the *Faceplate*.**

2 **With the *"Electric"* switch *ON*, locate the Electronic Controller's *JP-3 Plug* and check for DC voltage at *Pin 11 (+)* and *Pin 12 (-)*; reference Appendix A.**

If voltage is present:

Check for loose wire connections at *Pin 11 (+)* and *Pin 12 (-)* of the *JP-3 Plug*. If the wire connections are in good condition, proceed to Q2.

If no voltage is present:

The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If NO:

Perform each of the following procedures, as necessary, until the problem is resolved.

1 **Locate the *Electronic Control-ler* and remove the *Faceplate*.**

2 **Locate the Electronic Controller's *JP-2 Plug*. Use a jumper wire to make a connec-tion from the *Electric (O)* pin to the *Electric (I)* pin; reference Appendix A.**

Does the Electronic Controller's *Electric Heating Element Status light* illuminate? (continued in next column)

Section 7.10, continued

A: If YES: **Check for loose wire connections at the *"Electric"* switch and at the JP-2 Plug's *Electric (O)* and *Electric (I)* pins. If connections are in good condition, replace the *"Electric"* switch.**

If NO:

Locate the Electronic Controller's *JP-2 Plug* and check for DC voltage at the *Electric (O)* and *Electric (I)* pins; reference Appendix A and "NOTE (7.10-B)."

NOTE (7.10-B): Both *"Electric"* pins (i.e., *(O)* and *(I)*) should indicate a *positive (+)* DC voltage. Therefore, be sure to utilize the *"JP7 GND"* stud as a *ground (-) source* when performing this DC voltage check.

If no voltage is present:

The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Q2 Q2 : Has the

WARNING: Turn the *VAC breaker* ***OFF*** prior to performing the following checks. Failure to do so may result in serious bodily injury (**i.e., electrical shock**).

I. Remove the Aqua-Hot's *Thermostat Access Cover* and locate the *VAC High-Limit Thermostat*; reference Figure 1. Check for continuity at the *VAC High-Limit Thermostat*.

Is continuity present?

A: If YES:

Proceed to Q3.

If NO:

Press the red reset button located on the *VAC High-Limit Thermo-stat* and retest for continuity.

NOTE (7.10-C): Although the *120 VAC Electric Heating Element* should now function properly, be sure to perform the following steps until the cause for overheating has been discovered and corrected. Failure to do so could result in additional overheating incidents.

Section 7.10,
continued

I. Turn the *"Diesel"* switch ***ON*** and allow the *Aqua-Hot* to reach maximum operating temperature (i.e., until the *Diesel-Burner* cycles ***OFF***). Locate both the *VAC High- Limit Thermostat* and the *VAC/VDC Control Thermostat* and check for continuity; reference Figure 1.

A: If there is no continuity at the *VAC High-Limit Thermostat*, but there is continuity at the *VAC/VDC Control Thermostat*:

The *VAC/VDC Control Thermostat* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If there is continuity at the *VAC High-Limit Thermostat*, but none at the *VAC/VDC Control Thermostat*:

The overheat condition may have been caused by another faulty component, and no further troubleshooting is necessary; reference "NOTE (7.10-D)." Please contact the Technical Support Department at 1-800-685-4298 for additional assistance.

NOTE (7.10-D): If the *VAC High-Limit Thermostat* continues to trip, and no overheating problems were discovered (i.e., faulty *VAC/VDC Control Thermostat*), it may be that the *VAC High-Limit Thermostat* is not operating properly and may need to be replaced.

Q3 : Is VAC power bei[illegible] su[illegible] th[illegible] *R[illegible]*

WARNING: The following checks need to be performed with the motorhome connected to VAC power. Therefore, be sure to use extreme caution when performing each check, as 120 VAC power will be present at each of the electrical components. Failure to do so may result in serious bodily injury **(i.e., an electrical shock).**

Section 7.10,
continued

NOTE (7.10-E): The Temperature of the Aqua-Hot's *Boiler Tank* must be below 160°F prior to performing this test.

I. Turn the *"Electric"* switch ***ON*** and uncover the *VAC Relay* located on the reverse side of the *Thermostat Access Cover*; reference Figure 1. Check for AC voltage at both *Black (+)* wires ("120 VAC Power Supply") connections on the *VAC Relay*; reference Appendix A. Be sure to utilize the "JP7 GND" stud as a ground source when performing this AC voltage check.

Is voltage present?

A: If YES:
Proceed to Q4.
If NO:
1 **Check for loose wire connec- tions at the Motorhome's VAC junction box.**
2 **If the VAC wire connections are in good condition, please proceed to step 3.**
3 **Check the *VAC Relay* to ensure that it is functioning**

NOTE (7.10-F): Inspect the *VAC Relay* for damage. If visual signs of damage exist, the *relay* must be replaced.

I. Disconnect both *Black VAC wires* from the *VAC Relay terminals*. Activate the *"Electric"* switch ***ON*** and ***OFF***, then check for continu-ity across the two open *terminals*. Please note, with the *"Electric"* switch ***ON***, continuity should be present at the relay's *terminals*. With the *"Electric"* switch ***OFF***, no continuity should be present.

Is continuity present across the two *terminals* of the *VAC Relay*?

A: If YES:
Proceed to Q4.
If NO:
The *VAC Relay* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Section 7.10, continued

Q4 **Q4 : Is the *120 VAC Electric Heating Element* functioning pr**

WARNING: The following checks need to be performed with the Motorhome connected to VAC power. Therefore, be sure to use extreme caution when performing each check, as 120 VAC power will be present at each of the electrical components. Also, be sure to disconnect VAC power prior to replacing any electrical components. Failure to do so may result in serious bodily injury (**i.e., an electrical shock**).

I. Disconnect the Motorhome from VAC shore power and switch-off the Motorhome's Generator. Uncover the *120 VAC Electric Heating Element* located behind the *Electric Heating Element Access Cover*; reference Figure 1. Remove both the *Black* and *White* wires from the *120 VAC Electric Heating Element terminals*. Check for continuity across the two open *terminals*.

Is continuity present?

A: If YES: **Reference "NOTE (7.10-F)."**

If NO:

The *120 VAC Electric Heating Element* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

NOTE (7.10-F): If the *120 VAC Electric Heating Element* still does not seem to operate after performing all of the listed checks, contact the Technical Support Department at **1-800-685-4298** for additional assistance.

Section 7.11 After turning the *"Engine Preheat"* switch *ON*: TS11: The Aqua-Hot's Engine Preheat System does not preheat the engine.

NOTE (7.11-A): The *"Diesel"* or *"Electric"* switch must be activated, along with the *"Engine Preheat"* switch, prior to performing the following checks.

Q1 **Q1 : Is the Electronic Controller's *Engine Preheat Pump* light illuminated? (Reference Figure 5.)**

A: If YES: **Perform each of the following procedures, as necessary, until the problem is resolved.**

1 **Locate the *Electronic Control-ler* and remove the *Faceplate*.**

2 **Locate the Electronic Controller's *JP-3 Plug* and check for DC voltage at *Pin 7 (+)* and *Pin 8 (-)*; reference Appendix A.**

If voltage is present:

Check for loose wire connections at *Pin 7 (+)* and *Pin 8 (-)* of the *JP-3 Plug*. Also, check the wire connections at the *Engine Preheat Pump*. If all connections are in good condition, observe the *Engine Preheat Pump* to ensure that it is operating/rotating; reference Figure 1. If the *Engine Preheat Pump* is not operating/rotating, it must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If no voltage is present:

The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If NO:

Perform each of the following procedures, as necessary, until the problem is resolved.

1 **Locate the *Electronic Control-ler* and remove the *Faceplate*.**

2 **Locate the Electronic Controller's *JP-2 Plug*. Use a jumper wire to make a connec-tion from the *Preheat (O)* pin to the *Preheat (I)* pin; reference Appendix A.**

Section 7.11,
continued

Does the Electronic Controller's *Engine Preheat Pump* light now illuminate?

A: If YES: **Check for loose wire connections at the *"Engine Preheat"* switch and at the JP-2 Plug's *Preheat (O)* and *Preheat (I)* pins; reference Appendix A. If connections are in good condition, the *"Engine Preheat"* switch must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.**

If NO:
Locate the Electronic Controller's *JP-2 Plug* and check for DC voltage at the *Preheat (O)* pin; reference Appendix A.

NOTE (7.11-B): Be sure to utilize the *"JP7 GND" stud* as a *ground (-)* source when performing this DC voltage check.

NOTE (7.11-B): Be sure to utilize the *"JP7 GND" stud* as a *ground (-)* source when performing this DC voltage check. If no voltage is present:
The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.
If voltage is present:
Reference "NOTE (7.11-C)."

NOTE (7.11-C): If the *Engine Preheat Pump* still does not appear to operate after performing all of the listed checks, contact the Technical Support Department at 1-800-685-4298 for additional assistance.

NOTE (7.11-C): If the *Engine Preheat Pump* still does not appear to operate after performing all of the listed checks, contact the Technical Support Department at 1-800-685-4298 for additional assistance.

Recommended Maintenance

Monthly

Check the Aqua-Hot's water and antifreeze solution to ensure that it is at the proper level. Do this by visually checking the coolant level in the Aqua-Hot's *Expansion Tank*; reference Figure 1. This should be checked **only** when the *Aqua-Hot* is at maximum operating temperature (i.e., when the *Diesel-Burner* cycles ***OFF***), **"HOT."**

WARNING: When the *Aqua-Hot* is at maximum operating temperature (**HOT**), **DO NOT** loosen the *Radiator Cap*. If removed, scalding by hot vapor or coolant could result.

If the coolant needs replenishing, fill the Aqua-Hot's *Expansion Tank* to the **FULL HOT** level mark. Be sure to reference the Aqua-Hot "Owner's Manual" for the proper antifreeze type and mixture. If coolant frequently needs replenishing, please contact the Technical Support Department at **1-800-685-4298** for assistance.

Annually

WARNING: Before cleaning or servicing, disconnect all power supplies.

To keep the *Aqua-Hot* running smoothly, it is ideal to have the *Diesel-Burner* tuned-up annually. A tune-up should consist of a new *Fuel Nozzle* and *Fuel Filter*, along with a thorough cleaning of the *Combustion Chamber*, if necessary (reference Figure 9). To ensure maximum *Diesel-Burner* performance, always use the recommended *Fuel Nozzle* and *Fuel Filter* (i.e., 10 Micron) when replacing these parts. Reference Section 10 for spare parts information.

NOTE: Be sure to use care when handling the *Fuel Nozzle*. Oils and/or small dust or dirt particles from your hands may plug the nozzle's small orifice. A partially plugged orifice will restrict fuel flow, which will affect the combustion process of the *Diesel-Burner* (i.e., excessive smoking).

CAUTION: Operating the Aqua-Hot's *Diesel-Burner* or the *120 VAC Electric Heating Element* without the water and antifreeze solution will cause **serious damage** to the heater.

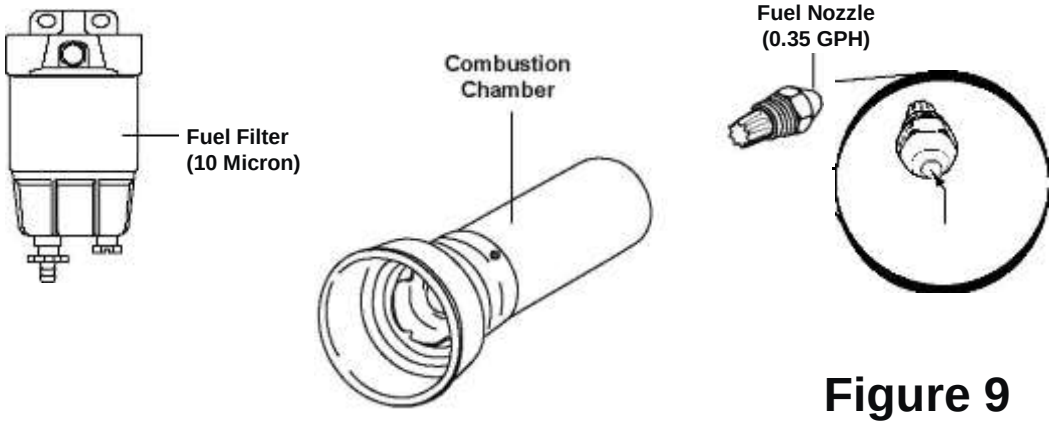


Figure 9

Detaching and Reattaching the Diesel-Burner Head

8.2 Detaching and Reattaching the Diesel-Burner Head

Detaching the Diesel-Burner Head

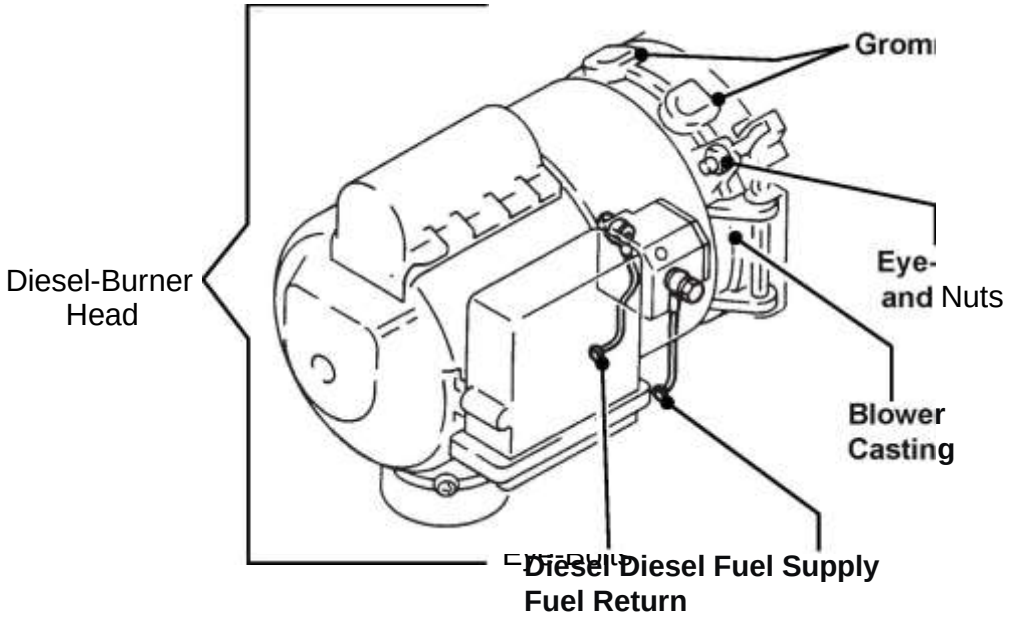


Figure 10

WARNING: Be sure to turn the *"Diesel"* switch ***OFF*** and disconnect the *B-Plug Harness* from the Diesel-Burner's *Controller* prior to detaching the *Diesel-Burner Head*; reference Figures 8 and 26. Failure to do so may result in the ignition of the *Diesel-Burner* and serious bodily injury.

1 Loosen the two *Eye-Bolt Nuts* and swing the *Eye-Bolts* out of the way; reference Figure 10.

2 With both hands, carefully pull the *Diesel-Burner Head* away from the *Aqua-Hot* (approximately 4-5 inches). Please note that you may have to lift the *Diesel-Burner Head* slightly while pulling it away from the *Aqua-Hot*.

3 Rotate the *Diesel-Burner Head* upward until all internal components are visible.

Reattaching the Diesel-Burner Grommets

CAUTION: When reattaching the *Diesel-Burner Head*, be sure to properly align the *Diesel-Burner Head* before tightening the *Eye-Bolt Nuts*. Also, visually inspect all of the rubber *Grommets* on the top and bottom of the *Diesel-Burner Head's* cast-aluminum *Blower Casting* to ensure they are in place. **DO NOT** overtighten the *Eye-Bolt Nuts* (torque specification = approximately 20-40 in. lbs.). An improper alignment and/or an overtightening of the *Eye-Bolt Nuts* can cause damage to the *Diesel-Burner Head's* cast-aluminum *Blower Casting*; reference Figure 10.

Function: The *Motor* drives the *Combustion Air Blower* and the *Fuel Pump*.

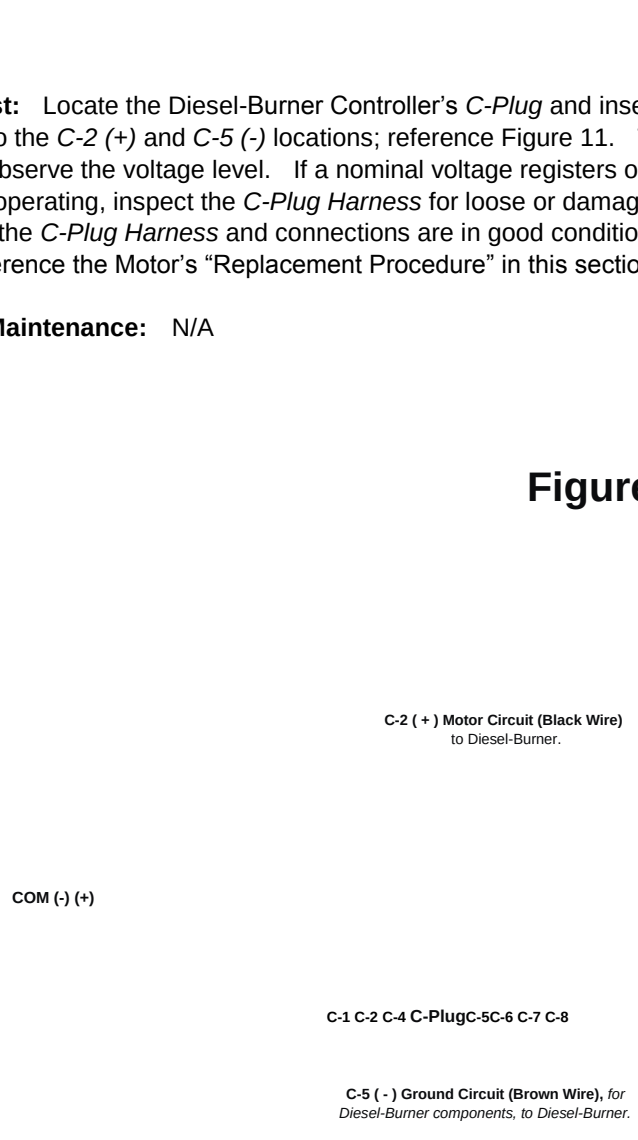
NOTE: In order to perform the following procedures, it may be necessary to detach and reattach the *Diesel-Burner Head*. Therefore, be sure to reference Section 8.2 for detaching and reattaching instructions.

NOTE: The functionality of each component can be determined by completing

Component Test: Locate the Diesel-Burner Controller's *C-Plug* and insert the probes of a DC voltmeter into the *C-2 (+)* and *C-5 (-)* locations; reference Figure 11. Turn the *"Diesel"* switch ***ON*** and observe the voltage level. If a nominal voltage registers on the voltmeter and the *Motor* is not operating, inspect the *C-Plug Harness* for loose or damaged wire connections. If the *C-Plug Harness* and connections are in good condition, the *Motor* must be replaced; reference the Motor's "Replacement Procedure" in this section.

Cleaning Tips/Maintenance: N/A

Figure 11



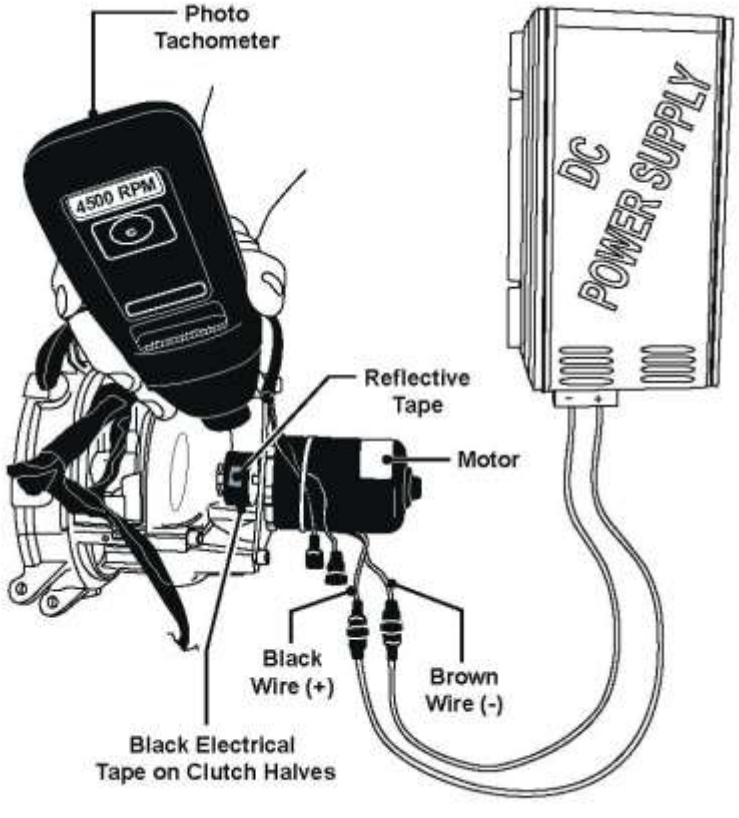
Motor,
continued

Adjustment Procedure: N/A

RPM Test: Disconnect the *Ignition Cables* from the *Ignition Electrodes*; reference Figure 16. Remove the four *Ignition Coil Screws*, which secure the *Ignition Coil* to the *Protection Housing*; reference Figure 13. Lift the *Ignition Coil* and disconnect its *wires* from the C-Plug Harness *wires* prior to removing. Remove the *Protection Housing* from the *Diesel-Burner,* allowing the *Motor and Clutch Halves* to be exposed; reference Figures 12 and 13. Place a few wraps of black electrical tape around the *Clutch Halves*, then, place a small piece of reflective tape over the black tape as illustrated in Figure 12. Disconnect the Motor's *Black (+)* and *Brown (-)* wires from the C-Plug Harnesses' *Black (+)* and *Brown (-)* wires; reference Figures 12 and 13. Connect the Motor's *wires* directly to a 12 Volt-DC power supply; reference Figure 12. Turn the power supply ***ON*** and use a photo-tachometer to test for a proper RPM reading; reference Figure 12. At approximately 12.5 Volts-DC, the RPM reading should be 4500 RPMs (+/- 300 RPMs). If the Motor's RPM reading is not within the above specs, the *Motor* must be replaced; reference the Motor's Replacement Procedure" in this section. Reference Section 10 for spare part number information.

NOTE: Prior to reattaching the *Diesel-Burner Head* or replacing the *Motor* (if applicable), be sure to test the Diesel-Burner's *Bearings*. Worn *Bearings* can cause lower than normal RPM readings and premature *Motor* wear. To properly test for worn *Bearings*, reference Section 8.9 for the Bearings "Function Test."

Figure 12



Motor,
continued

Replacement Procedure:

1. Remove the four *Ignition Coil Mounting Screws*, which secure the *Ignition Coil* to the *Protection Housing*; reference Figure 13. Lift the *Ignition Coil* to disconnect its wires from the C-Plug Harness *wires* prior to removing. Remove the *Protection Housing* from the *Diesel-Burner* to expose the *Motor* and *Clutch Halves*; reference Figures 13 and 14.

2. Remove the three *Hex Head Screws,* which secure the *Motor* and flange assem-bly to the *Blower Housing*; reference Figure 13. Remove the *Motor* and flange assembly along with the *Clutch Halves*; reference Figures 13 and 14. Discon-nect the Motor's *Black (+)* and *Brown (-)* wires from the C-Plug Harness' *wires*; reference Figure 13.

NOTE: Inspect the *Clutch Halves* for cracks and ensure that the flat portion in each shaft hole is free of wear and tear. Too much play on the shaft produces a loud clacking noise. If any cracks or wear are detected, the *Clutch Half* must be replaced. Reference the Aqua-Hot's "Parts Manual" for spare parts information.

NOTE:

3. Detach the *Motor* from the *Motor Flange* by removing the two *Phillips Head Screws*, which fasten the two parts together; reference Figure 13.

NOTES:

A: Be sure to test the Diesel-Burner's *Bearings* prior to reinstalling the *Motor*. Worn *Bearings* can cause lower than normal RPM readings and premature *Motor* wear. To properly test for worn *Bearings*, reference Section 8.9 for the Bearings "Function Test."

B: The *Motor* must be mounted to the flange with the *wires* and drain hole pointing downward and the recessed edge of the *Motor Flange* pointing upward; reference Figure 14. This will ensure a proper *Protection Housing* fit.

NOTES:

4. Reinstall a *Clutch Half* on both the new Motor's shaft and the Combustion Air Blower's shaft. Attach the *Motor* and the flange assembly, with the recessed edge of the *Motor Flange* in-line with the Wiring Access Slot of the *Blower Cast-ing*, to the *Blower Housing* with the three *Hex Head Screws*; reference Figure 14.

NOTE: Inspect the Blower Casing's *O-Ring* for damage or wear prior to reinstall-ing the Diesel-Burner Head's *Protection Housing*; reference Figure 14. If damage or wear exists, replace the *O-Ring*. Reference the Aqua-Hot's "Parts Manual" for spare parts information.

NOTE:

5. Connect the *Black (+)* and *Brown (-)* wires of the new *Motor* to the C-Plug Harness *Black (+)* and *Brown (-)* wires; reference Figure 13. Feed the C-Plug Harness *Yellow* and *Brown* wires back through the *Wiring Access Hole* in the *Protection Housing*; reference Figure 13.

6. Reinstall the *Protection Housing*. Reconnect the *Black (+)* and *Brown (-)* wires of the *Ignition Coil* to the C-Plug Harness' *Yellow (+)* and *Brown (-)* wires; refer-ence Figure 24. Reinstall the *Ignition Coil* and secure to the *Protection Housing* with the four *Ignition Coil Mounting Screws*; reference Figure 13.

Motor,
continued

Figure 13

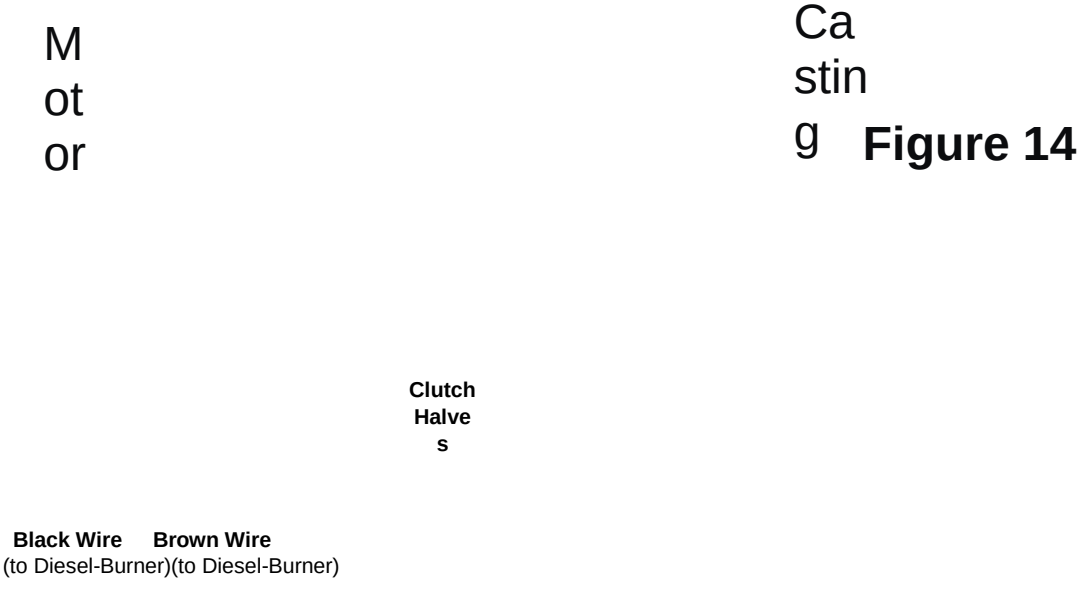


Figure 14

Sensor

Function: The *Flame Sensor* is a photoresistive device, which supplies the Diesel-Burner's *Controller* with a DC voltage signal when it detects a flame (i.e., a light source).

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information

NOTES:

A: In order to perform the following procedures, it is necessary to detach and reattach the *Diesel-Burner Head*. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

B: Be sure to calibrate your ohmmeter prior to checking the *Flame Sensor* for proper resistance values.

Component Test: Locate and detach the Flame Sensor's *Green* and *Blue* wires from the C-Plug Harness *wires*; reference Figure 15. Connect the Flame Sensor's *Green* and *Blue* wires to an ohmmeter; reference Figure 15. Check resistance by placing a shop rag over the Flame Sensor's glass surface to simulate a no-flame condition, then, remove the rag (and expose to a light source) to simulate a flame condition. If the *Flame Sensor* is operating properly, the ohmmeter should register high resistance (i.e., 100K Ω +) when the glass surface is covered and less than 300 Ω when exposed to a light source. If these resistance numbers cannot be obtained, the *Flame Sensor* must be replaced; reference the Flame Sensor's "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

Cleaning Tips/Maintenance: For light dirt, dust, and/or carbon deposits, simply wipe off the *Flame Sensor* with a soft cloth. Should heavy carbon deposits exist, completely remove the *Flame Sensor* form the *Photo Disc* and clean with brake cleaner; reference Figure 15.

Adjustment Procedure: N/A

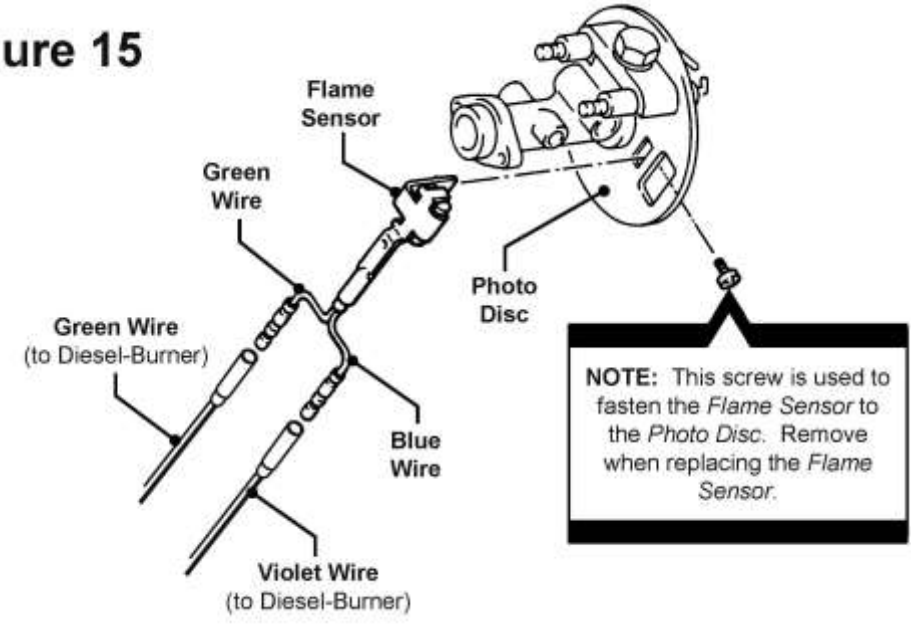
Replacement Procedure:

1 Remove the *Screw*, which fastens the *Flame Sensor* to the *Photo Disc* and detach the sensor's *Green* and *Blue* wires from the C-Plug Harness' *Green* and *Violet* wires; reference Figure 15.

2 Slide the tab of the new *Flame Sensor* into the provided slot in the *Photo Disc* and secure in place with the screw; reference Figure 15. Connect the Flame Sensor's *Green* wire to the *Green* C-Plug Harness wire and the *Blue* wire to the C-Plug Harness' *Violet* wire; reference Figure 15.

Flame Sensor, continued

Figure 15


Flame Sensor
Green Wire
Photo Disc
Green Wire (to Diesel-Burner)
Blue Wire
Violet Wire (to Diesel-Burner)
NOTE: This screw is used to fasten the Flame Sensor to the Photo Disc. Remove when replacing the Flame Sensor.

Ignition Electrodes

8.5 Ignition Electrodes

Function: The Diesel-Burner's *Ignition Coil* (reference Figure 24) produces a high voltage ignition spark across the *Ignition Electrodes*, which ignites the incoming air/fuel mixture.

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

NOTE: In order to perform the following procedures, it is necessary to detach and reattach the *Diesel-Burner Head*. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

Component Test: N/A

Cleaning Tips/Maintenance: Polish away any carbon deposits, which may have baked onto the metal tips of the *Ignition Electrodes* with a Scotch Brite® pad (or similar); reference Figure 16. If the Ignition Electrode's *electrical insulator* (reference Figure 16) is cracked and/or damaged, the *Ignition Electrode* must be replaced; reference the Ignition Electrode "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

NOTE: The *Electrode Adjustment Gauge* is used to set the gap between the *Ignition Electrodes*. The *Electrode Adjustment Gauge* is located on the outside surface of the *Diesel-Burner Head* on the left side.

NOTE: The *Electrode Adjustment Gauge* is used to set the gap between the *Ignition Electrodes*. The *Electrode Adjustment Gauge* is located on the outside surface of the *Diesel-Burner Head* on the left side.

Adjustment Procedure: An adjustment of the *Ignition Electrodes* can be accomplished by performing the following procedure:

1 Slightly loosen the *Retaining Clamp Bolt*; reference Figure 16.

2 Place the *Electrode Adjustment Gauge* on the *Fuel Nozzle Manifold Hex* (reference Figure 17) and insert the metal tips of the *Ignition Electrodes*

Ignition Electrodes, illustrated in Figure 16.

into the appropriate notches of the *Electrode Adjustment Gauge* as continued

3. Tighten the *Retaining Clamp Bolt*.

> **NOTE:** Be sure not to overtighten the *Retaining Clamp Bolt* when readjusting the *Ignition Electrodes*. Overtightening the *Retaining Clamp Bolt* will bend the *Retaining Clamp* and prevent the *Photo Disc* from floating freely (i.e., loose fit). Not allowing the *Photo Disc* to float freely will cause poor combustion and result in a smoky exhaust. A bent *Retaining Clamp* can be restraightened with a punch and hammer. Lay the clamp's beveled side down on a solid flat surface and align the thick end of the punch at dead center. Tap the punch lightly until the *Retaining Clamp* returns to proper form (i.e., flat).

4. Remove the *Electrode Adjustment Gauge* and reattach to the *Diesel-Burner Head*.

Replacement Procedure:

1 Disconnect the *Ignition Cables* from the *Ignition Electrodes* and slightly loosen the *Retaining Clamp Bolt* just enough to allow the *Ignition Elec-trodes* to be removed; reference Figure 16.
2 Slide the new *Ignition Electrodes* up through the *Retaining Clamp* and *Photo Disc*. Do not tighten the *Retaining Clamp Bolt* at this time.
3 Perform Steps 2 through 4 of this section's "Adjustment Procedure" to complete the *Ignition Electrode* installation. Once Steps 2 through 4 have been performed, reconnect the *Ignition Cables* to the *Ignition Elec-trodes*; reference Figure 16.

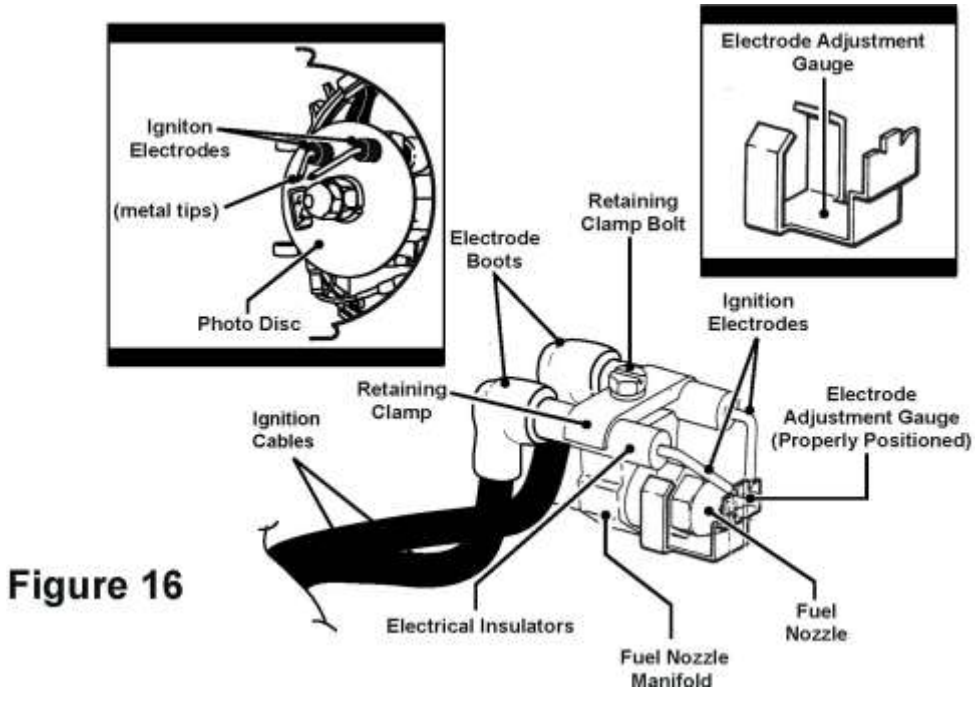


Figure 16

Nozzle

Function: The *Fuel Nozzle* is simply a fuel atomizer. It reduces the diesel fuel into a fine spray, which is mixed with incoming combustion air and ignited within the *Combustion Chamber*.

> **NOTE:** The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

> **NOTE:** In order to perform the following procedures, it is necessary to detach and reattach the *Diesel-Burner Head*. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

Component Test: Remove both *Ignition Cables* from the *Ignition Electrodes;* reference Figure 16.

> **WARNING:** Failure to remove the *Ignition Cables/Electrode Boots* from the *Ignition Electrodes* (reference Figure 16), will result in a **HIGH VOLTAGE** shock and/or a fire. Also, be sure to place a piece of electrical tape on the end of each Electrode Boot.

Remove the *B-Plug* from the Diesel-Burner's *Controller*; reference Figure 8. Turn the *"Diesel"* switch ***ON*** (reference Figure 4), then, plug the *B-Plug* back into the *Controller* to activate the *Diesel-Burner*. After approximately 20 seconds, the *Fuel Solenoid* will "click" and a fine mist of fuel should appear from the *Fuel Nozzle* in a cone-shaped spray pattern. Remove the *B-Plug* from the *Controller*. If the cone-shaped spray pattern did not appear, the *Fuel Nozzle* must be replaced; reference the Fuel Nozzle's "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

Cleaning Tips/Maintenance: The *Fuel Nozzle* is a precision calibrated part and **cannot** be cleaned or serviced. A replacement of the *Fuel Nozzle* is recommended annually. Reference Section 8.1 for maintenance information.

Adjustment Procedure: N/A

Replacement Procedure:

1 Use a 3/4 in. wrench to hold the *Fuel Nozzle Manifold Hex* while loosening the *Fuel Nozzle* with a 5/8 in. wrench; reference Figure 17.

2 When replacing the *Fuel Nozzle*, be sure to tighten the nozzle, loosen it a 1/4

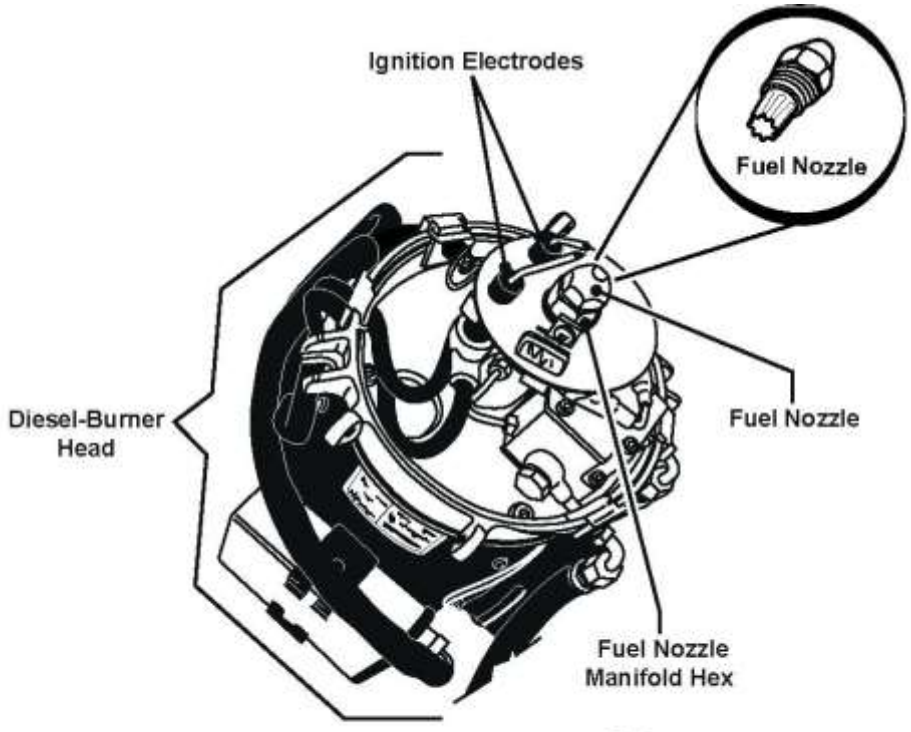
> **NOTE:** Be sure to use care when handling the new *Fuel Nozzle*. Oils and/or small dust or dirt particles from your hands may plug the nozzle's small orifice. A partially plugged orifice will restrict fuel flow, which will affect the combustion process of the *Diesel-Burner* (i.e., excessive smoking).

> **NOTE:** An adjustment of the *Ignition Electrodes* may be necessary after replacing the *Fuel Nozzle*. Reference Section 8.5 for the Ignition Electrode "Adjustment Procedure."

Fuel Nozzle, continued

WARNING: Be sure to reattach the *Diesel-Burner Head* prior to switching the heater ***ON***. Failure to do so may result in ignition of the *Diesel-Burner* and serious bodily injury.

4. Turn ***ON*** the *"Diesel"* switch (reference Figure 4) for 5 seconds, then turn it ***OFF***. This will activate the Diesel-Burner's prime-cycle (will operate the Diesel-Burner's "Motor" for 2-3 minutes) and flush the fuel system of any potential contaminants. Perform this procedure twice.



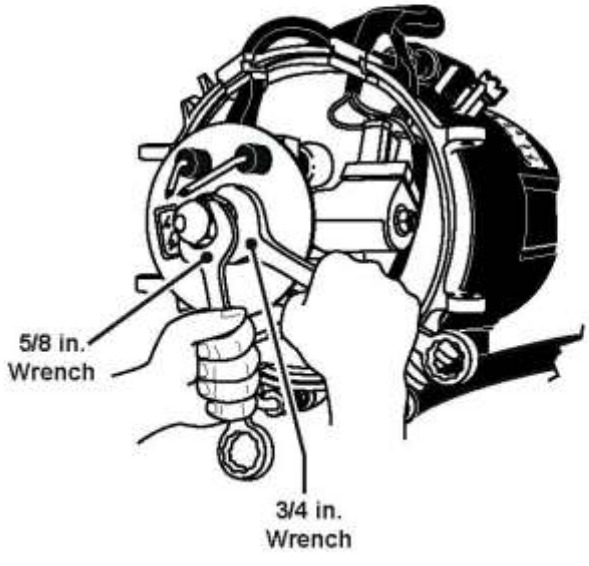


Figure 17

Solenoid Valve

Function: The *Fuel Solenoid Valve* allows the flow of diesel fuel to the Diesel-Burner's *Fuel Nozzle*.

> **NOTE:** In order to perform the following procedures, it is necessary to detach and reattach the *Diesel-Burner Head*. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

> **NOTE:** The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

Component Test: Locate and detach the C-Plug Harness' *Violet (+)* and *Brown (-)* wires from the *Fuel Solenoid Valve*. Connect the (-) lead of a 12 Volt-DC power supply to the Fuel Solenoid's (-) *Electrical Terminal*; reference Figure 18. Now, intermittently apply the (+) lead of the power supply to the Fuel Solenoid's (+) *Electrical Terminal* and listen for the *Fuel Solenoid* to click (i.e., open and close). If the *Fuel Solenoid* does not click, it must be replaced; reference the Fuel Solenoid Valve's "Replacement Procedure" below. Reference Section 10 for spare parts information.

Cleaning Tips/Maintenance: N/A

Adjustment Procedure: N/A

Replacement Procedure:

1 Disconnect the *Ignition Cables* from the *Ignition Electrodes* and loosen the *Retaining Clamp Bolt*; reference Figure 16.

2 Remove the *Retaining Clip*, which secures the *Photo Disc* in place. Gently lift the *Photo Disc* (with *Flame Sensor* attached) so that it releases from the *Fuel Nozzle Manifold* and the *Ignition Electrodes*; reference Figures 16 and 19.

3 Disconnect the C-Plug Harness' *Violet (+)* and *Brown (-) wires* from the *Fuel Solenoid Valve*; reference Figure 18.

4 Remove the four *Fuel Nozzle Manifold Plate Screws*, which secure the *Fuel Nozzle Manifold Plate* in place; reference Figure 19. Remove the *Fuel Nozzle Manifold Plate* by pulling on the *Fuel Nozzle Manifold* until the plate releases from the cast-aluminum *Blower Casting*; reference Figures 13 and 19.

5 Remove the *Lock Nut* and *Flat Washer* from the end of the *Fuel Solenoid Shaft*, then, remove the *Fuel Solenoid Valve Coil*. With a 5/8 wrench, now remove the *Fuel Solenoid Shaft* from the *Fuel Nozzle Manifold*. Discard the shaft and valve kit, as replacements are provided with the new *Fuel Solenoid Assembly*; reference Figure 18.

6 Insert the contents of the new *Fuel Solenoid Valve Kit* into the new *Fuel Solenoid Shaft* as illustrated in Figure 18. Thread the new *Fuel Solenoid Shaft* to the *Fuel Nozzle Manifold* and tighten. Slide the new *Fuel Solenoid Valve Coil* onto the *Fuel Solenoid Shaft* and secure in place with the new *Flat Washer* and *Lock Nut*.

Valve, **7.** Fit the *Fuel Nozzle Manifold Plate* inside the cast-aluminum *Blower Casting* and continued secure in place with the four *Fuel Nozzle Manifold Plate Screws*.

1 Reinstall the *Photo Disc* and secure in place with the *Retaining Clip*. Connect the *C-Plug Harness' Violet (+)* and *Brown (-)* wires to the Fuel Solenoid Valve's *(+)* and *(-) Electrical Terminals*; reference Figure 18.

2 Perform the Ignition Electrodes' "Adjustment Procedure" in Section 8.5 to complete the *Fuel Solenoid Valve* installation.

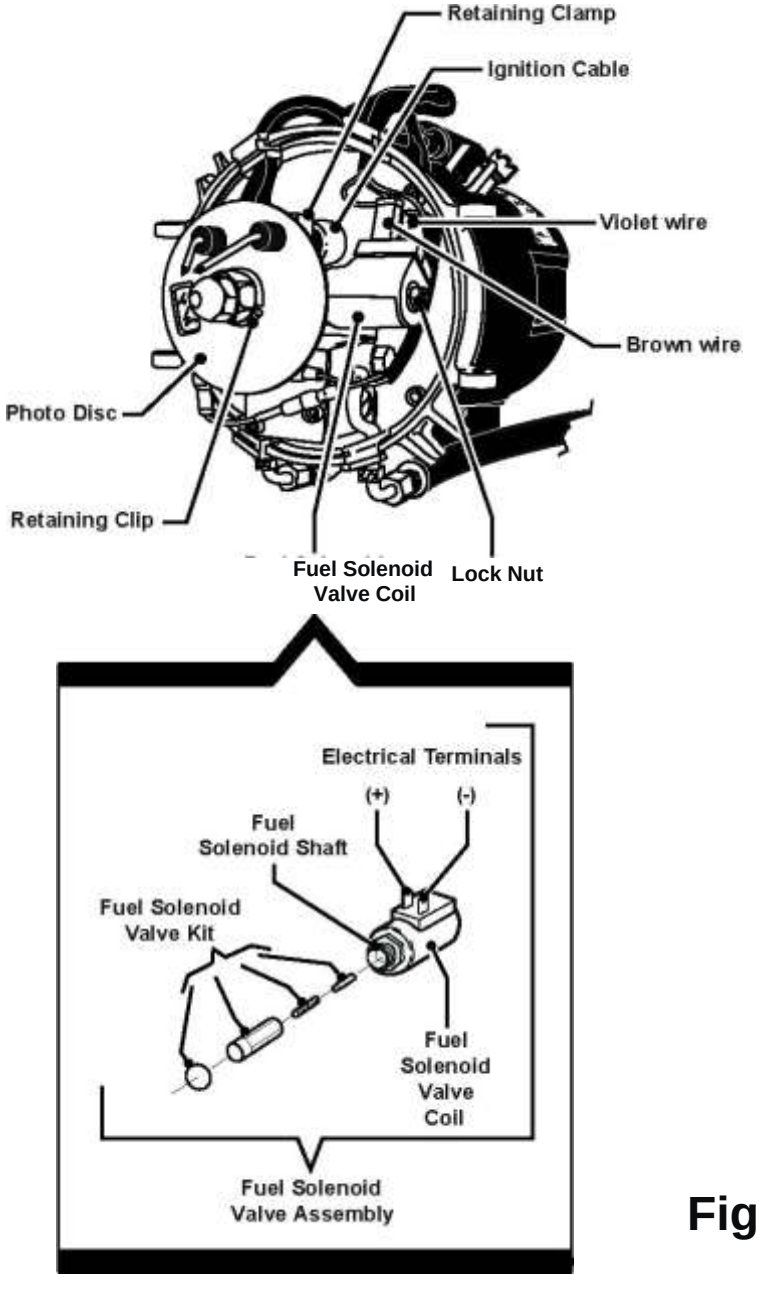
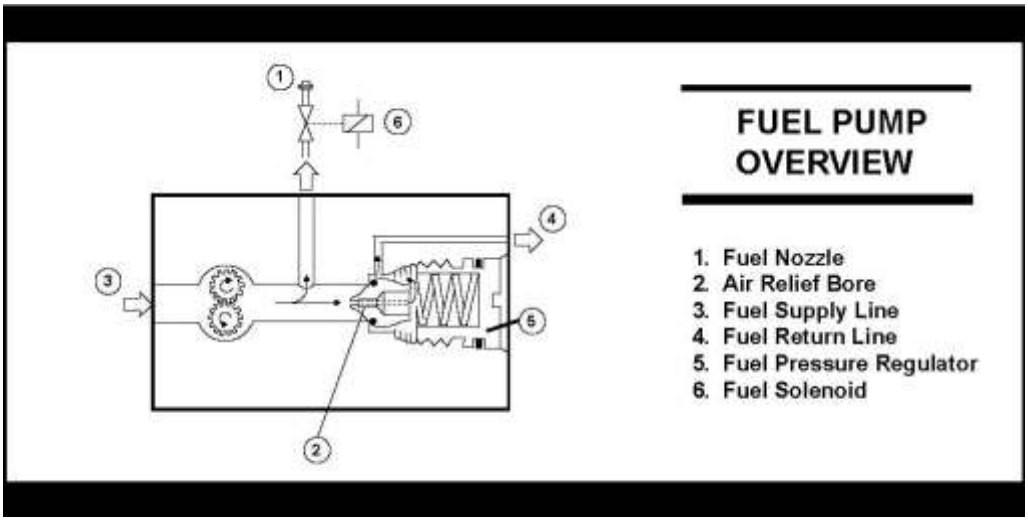


Figure 18

Fuel Pump 8.8 Fuel Pump

Function: The *Fuel Pump* draws diesel fuel from the vehicle's fuel tank and creates a preset pressure of 145 psi (required for proper fuel atomization). Reference the illustration below for a basic overview and understanding of how the *Fuel Pump* operates.



NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

NOTE: In order to perform some of the following procedures, it may be necessary to detach and reattach the *Diesel-Burner Head*. Therefore, be sure to reference Section 8.2 for detaching and reattaching instructions.

Component Test:

Clamp off and remove the Aqua-Hot's *Fuel Return* and *Fuel Supply Lines*; reference Figure 1. Attach a short piece of fuel line to both the Aqua-Hot's *Fuel Return* and *Fuel Supply* ports; reference Figure 1. Submerse the opposite end of the temporary fuel supply line in a container of diesel fuel. Place the opposite end of the temporary fuel return line in an empty container. Turn the *"Diesel"* switch ***ON*** to activate the *Diesel-Burner*; reference Figure 4. If fuel does not flow out of the return line into the empty container, the *Fuel Pump* must be replaced; reference the Fuel Pump's "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

Cleaning Tips/Maintenance:

1. Check all *Fuel Connections* for tightness (i.e., *Banjo Bolts, High Pres-sure Fuel Pipe Connections*); reference Figure 19.

Pump,
continued

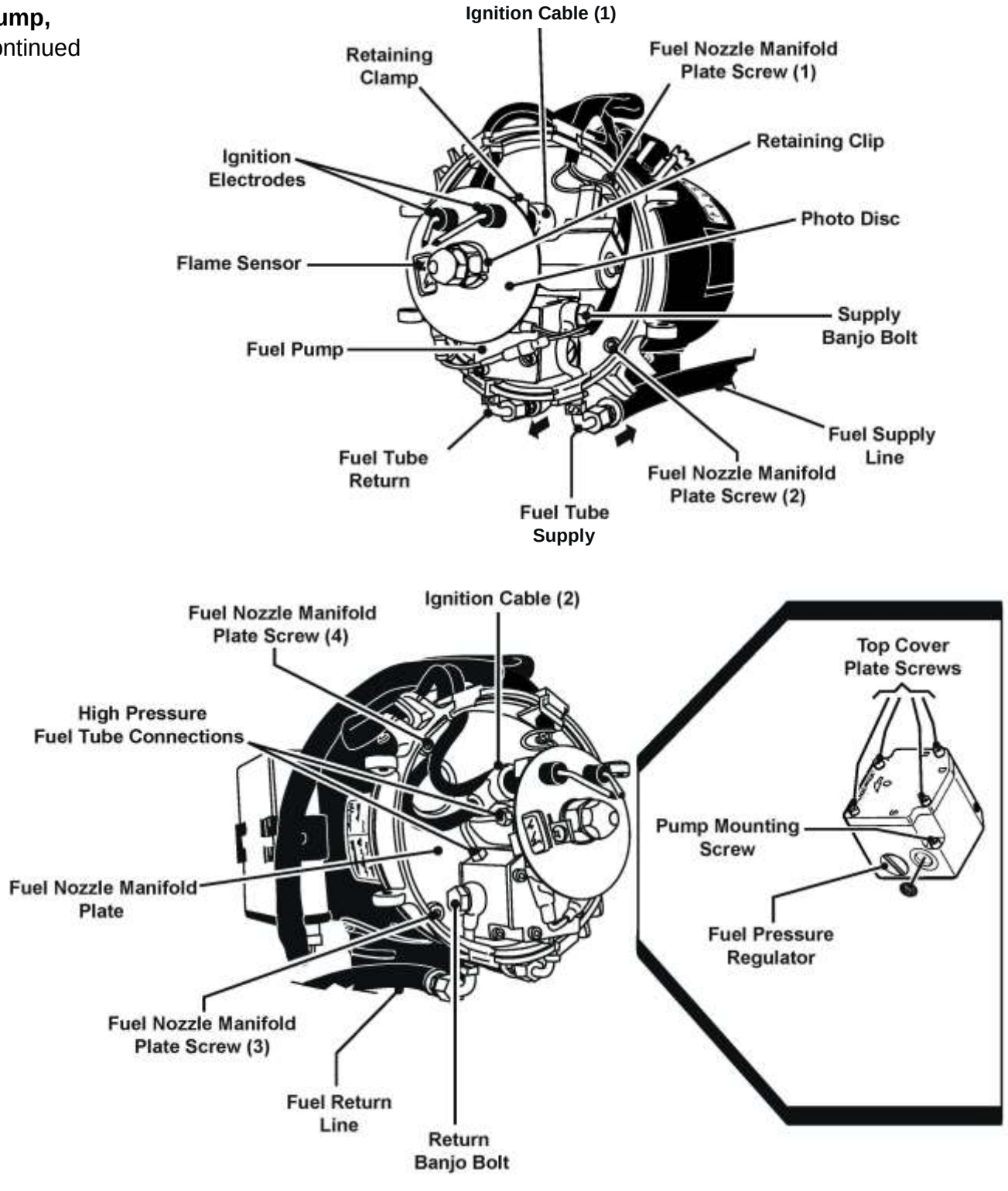


Figure 19

Pump,
continued

Fuel Pressure Function Test:

NOTES:

A: A *Fuel Pressure Gauge* (reference Section 11 for special tools information) is used to properly check the Fuel Pump's pressure setting; reference Figure 21. The *Fuel Pump* is preset to 145 psi (the pressure required for proper fuel atomization at the *Fuel Nozzle*). Perform the following procedures to check for a proper fuel pressure setting.

B: Be sure to use care when handling the *Fuel Nozzle*. Oils and/or small dust or dirt particles from your hands may plug the nozzle's small orifice; reference Figure 9. A partially plugged orifice will restrict fuel flow, which will affect the combustion process of the *Diesel-Burner* (i.e., excessive smoking from the exhaust pipe).

1. Remove the *Fuel Nozzle* (reference Figure 17) and replace it with the *Fuel Pressure Gauge*; reference Figure 21.

WARNING: A spark will appear across the *Ignition Electrodes* (reference Figure 16) for a brief moment after the *Diesel-Burner* has been activated. **DO NOT** attempt to make any fuel pressure adjustments until the spark has disappeared. Failure to do so may result in serious bodily injury (**i.e., an electrical shock**).

2. Turn the *"Diesel"* switch ***ON***; reference Figure 4. A pressure will register on the *Fuel Pressure Gauge* once the *Fuel Solenoid* opens (after approximately 10-25 seconds).

3. If the *Fuel Pressure Gauge* registers a 145 psi pressure reading, no pressure adjustment is necessary. Turn the *"Diesel"* switch ***OFF*** and wait until the motor stops running. Remove the *Fuel Pressure Gauge* and reinstall the *Fuel Nozzle* (reference Section 8.6 for the Fuel Nozzle's "Replacement Procedure"). Reattach the *Diesel-Burner Head.*

NOTE: If the *Fuel Pressure Gauge* registers below or above 145 psi, perform the adjustment procedures listed below.

Fuel Pressure Adjustment Procedure:

1 Turn the *"Diesel"* switch ***ON*** and wait until a pressure reading registers on the *Fuel Pressure Gauge* (after approximately 10-25 seconds). Then, adjust the fuel pressure by simply turning the *Pressure Regulator Adjustment Screw* clockwise to increase fuel pressure or counterclock-wise to decrease fuel pressure; reference Figure 21.

2 Once the pressure adjustment has been made, turn the *"Diesel"* switch ***OFF***

NOTE: If the fuel pressure will not maintain a 145 psi setting, the *Fuel Pump* must be replaced; reference the Fuel Pump's "Replacement Procedure" in this section. Also, reference Section 10 for spare parts information.

Pump,
continued

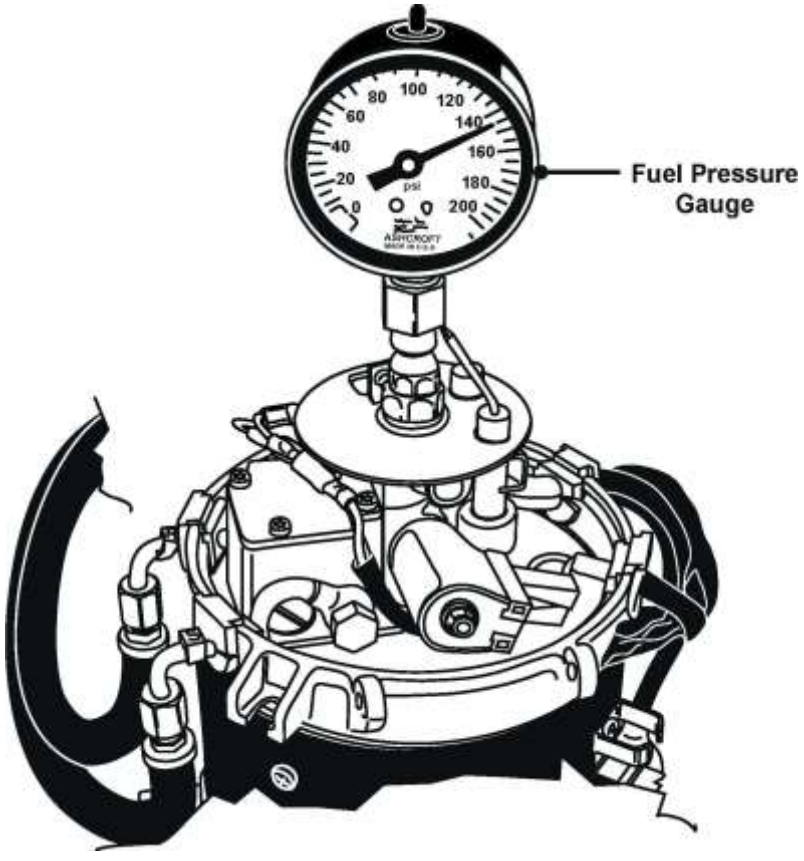


Figure 20

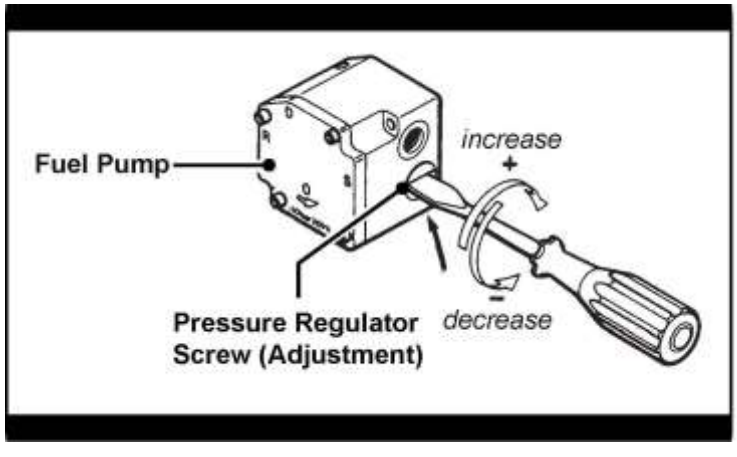


Figure 21

Fuel Pump,
continued

Replacement Procedure:

1. Locate and disconnect the C-Plug Harness *wires*, which connect to the *Flame Sensor* and the *Fuel Solenoid Valve*; reference Figures 3, 15, and 18. Also, disconnect the *Ignition Cables* from the *Ignition Electrodes*; reference Figures 16 and 19.

1 Remove the *Retaining Clip*, which secures the *Photo Disc* in place; reference Figure 19. Gently lift the *Photo Disc* (with *Flame Sensor* attached) so that it releases from the *Fuel Nozzle Manifold* and the *Ignition Electrodes*; reference Figures 16 and 19.

2 Clamp off both the *Fuel Supply Line* and *Return Line* from the *Diesel-Burner Head*; reference Figures 19 and 22. Loosen the *Supply* and *Return Banjo Bolts* to remove both Fuel Tubes (with the fuel lines attached) from the *Fuel Pump*; reference Figures 19 and 22. Also, disconnect the *High Pressure Fuel Tube* from both the *Fuel Pump* and the *Fuel Nozzle Manifold*; reference Figures 19 and 22. Discard the *High Pressure Fuel Tube*, *Gasket Rings*, *Banjo Bolts*, and *Grommets*, as these replacements are provided in the new Fuel Pump Kit. Reference Section 10 for spare parts information.

3 Remove the four *Fuel Nozzle Manifold Plate Screws*, which secure the *Fuel Nozzle Manifold Plate* in place; reference Figure 19. Remove the *Fuel Nozzle Manifold Plate* by pulling on the *Fuel Nozzle Manifold* until the plate releases from the cast-aluminum *Blower Casting*; reference Figures 13 and 19.

4 Remove the two *Fuel Mounting Screws*, which secure the *Fuel Pump* in place; reference item 70 of Figure 22. Turn the *Fuel Nozzle Manifold Plate* over and remove the *Snap Ring* from the Fuel Pump shaft using Snap Ring pliers; reference item 77 of Figure 22. Remove the nylon *Fuel Pump Gear,* then the *Fuel Pump*; reference items 88 and 72 of Figure 22.

5 Attach the new *Fuel Pump* to the *Fuel Nozzle Manifold Plate* with the two *Fuel Pump Mounting Screws*. Turn the *Fuel Nozzle Manifold Plate* over to install the nylon *Fuel Pump Gear* on the Fuel Pump's shaft and secure in place with the *Snap Ring*. Dab the teeth of the nylon *Fuel Pump Gear* with white lithium grease (Isoflex LDS-18 is recommended).

NOTES:

A: All new Fuel Pumps are factory preset to 145 PSI; therefore, no fuel pressure adjustment is necessary.

B: Inspect the nylon Fuel Pump Gear's cavity inside the cast aluminum *Blower Casting* for fuel stains. If fuel stains are present, a replacement of the *Bearings* and/or the entire *Blower Casting* may be necessary (leaking fuel could cause *Bearing* seizure, resulting in potential damage to the internal bore/bearing cavity of the *Blower Casting*). Reference Section 8.9 for the Bearing Replacement Procedure, and contact the Technical Support Department at **1-800-685-4298** for additional assistance.

NOTES:

7. Fit the *Fuel Nozzle Manifold Plate* inside the cast-aluminum *Blower Casting*

Supply

Cover

Boiler Tank
Drain Valve

Diesel Fuel
Supply

Diesel-Burner
Controller

Diesel Fuel
Return

Pressure-Relief
Valve

Hot Water Outlet (Domestic Water)

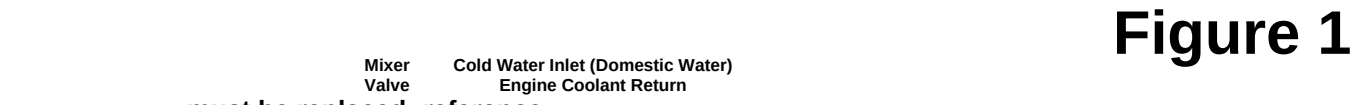


Figure 1

must be replaced; reference

Appendix A. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

If NO:

The *Electronic Controller* must be replaced. Please contact the Technical Support Department at 1-800-685-4298 for assistance.

Diesel-Burner
Controller

Diesel-Burner
Head

Ignition Coil

Ignition Electrodes

Photo Disc

Fuel Solenoid

Flame Sensor

Fuel Pump

Diesel-Burner
Controller

Fuel
Nozzle

Diesel-Burner
Controller

Diesel-Burner
Head

Ignition Coil

Ignition
Electrodes

Photo Disc

Fuel Solenoid

Flame Sensor

Bearings

8.9 Bearings Function: The *Bearings* support the Combustion Air Blower's shaft and allows the blower to turn smoothly.

> **NOTE:** The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

> **NOTE:** In order to perform some of the following procedures, it is necessary to detach and reattach the *Diesel-Burner Head*. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

Function Test: Remove the *Motor* (reference Section 8.3 for the Motor's "Replacement Procedure") and spin the *Combustion Air Blower* by hand (place one of the *Clutch Halves* to the end of the shaft to assist with this spinning exercise). If the *Combustion Air Blower* rotates smoothly without any friction or noise, the *Bearings* are in proper working condition. However, if the *Combustion Air Blower* does not rotate smoothly and/or produces noise, the *Bearings* are worn and must be replaced; reference the Bearings "Replacement Procedure" in this section.

Component Test: N/A

Cleaning Tips/Maintenance: N/A

Adjustment Procedure:

N/A

Replacement Procedure:

1 Clamp off and remove the *Fuel Supply Line* and *Fuel Return Line* from the *Diesel-Burner Head*; reference Figures 19 and 22.

2 Locate and disconnect the *C-Plug* Harness *wires*, which connect to the *Flame Sensor* and *Fuel Solenoid*; reference Figures 3, 15, and 18. Also, disconnect the *Ignition Cables* from the *Ignition Electrodes*; refer-ence Figures 16 and 19.

3 Remove the four *Fuel Nozzle Manifold Plate Screws*, which secure the *Fuel Nozzle Manifold Plate* in place; reference Figure 19. Remove the *Fuel Nozzle Manifold Plate* by pulling on the *Fuel Nozzle Manifold* until the plate releases from the cast-aluminum *Blower Casting*; reference Figures 13, 16, and 19.

4 Remove the four *Ignition Coil Mounting Screws*, which secure the *Ignition Coil* to the *Protection Housing*; reference Figure 13. Lift the *Ignition Coil* and disconnect its *Black (+)* and *Brown (-) wires* from the *C-Plug* Harness *wires*, prior to removing; reference Figures 3 and 24. Remove the *Protection Housing* from the *Diesel-Burner* to expose the *Motor* and *Clutch Halves*; reference Figures 12, 13 and 14.

5 Remove the three *Hex Head Screws*, which secure the *Motor* and *Motor Flange* to the *Blower Housing*; reference Figure 13. Remove the *Motor* and flange assembly along with the *Clutch Halves*; reference Figures 13 and 14. Disconnect the Motor's *Black (+)* and *Brown (-) wires* from the *C-Plug* Harness' *wires*; reference Figure 13.

Bearings,
continued

> **NOTE:** Inspect the *Clutch Halves* for cracks and ensure that the flat portion in each shaft hole is free of wear and tear. Too much play on the shaft produces a loud clacking noise. If any cracks or wear are detected, the *Clutch Half* must be replaced. Reference the Aqua-Hot's "Parts Manual" for spare parts information.

NOTE: Inspect the *Clutch Halves* for cracks and ensure that the flat portion in each shaft hole is free of wear and tear. Too much play on the shaft produces a loud clacking noise. If any cracks or wear are detected, the *Clutch Half* must be replaced. Reference the Aqua-Hot's "Parts Manual" for spare parts information.

6. Remove the four *Blower Housing Screws*, which secure the *Blower Housing* to the *Blower Casting*; reference Figure 23. Remove the *Blower Housing* to expose the *Combustion Air Blower*; reference Figure 23.

> **NOTE:** Be sure to observe the placement of the three *Washers* of the Bearing Kit illustrated in Figure 23. To ensure proper tension, the same order and direction of the dished surfaces of the *Washers* must be followed when reassembling.

NOTE: Be sure to observe the placement of the three *Washers* of the Bearing Kit illustrated in Figure 23. To ensure proper tension, the same order and direction of the dished surfaces of the *Washers* must be followed when reassembling.

7. Hold Side-B of the *Blower Casting* and loosen the *Retaining Nut* located in Side-A of the *Blower Casting*. Remove the *Retaining Nut*, steel *Drive Gear*, and thick *Flat Washer* from the Combustion Air Blower's shaft. Lightly tap the threaded end of the shaft so the *Combustion Air Blower* can be easily removed from the *Blower Casting*.

8. With a pair of Snap-Ring pliers, remove the *Snap Rings* from both Side-A and Side-B of the Blower Casting; reference Figure 23. Push all the contents of the Bearing Kit out of the Blower Casting's bore/bearing cavity. Discard the *Retaining Nut*, steel *Drive Gear*, *Snap Rings*, *Bear- ings*, *Spacer Tube*, and *Washers*, as replacements are provided in the new Bearing Kit.

> **NOTE:** Be sure to inspect the Blower Casting's bore/bearing cavity for signs of damage due to potentially seized *Bearings*. If damage is present, the *Blower Casting* must be replaced. Reference the Aqua-Hot's "Parts Manual" for spare parts information.

NOTE: Be sure to inspect the Blower Casting's bore/bearing cavity for signs of damage due to potentially seized *Bearings*. If damage is present, the *Blower Casting* must be replaced. Reference the Aqua-Hot's "Parts Manual" for spare parts information.

9. Install a new *Snap Ring* into Side-A of the *Blower Casting*; reference Figure 23. Once the Snap Ring is in place, insert the remaining contents of the new Bearing Kit into Side-B of the *Blower Casting* starting with the *Wave Washer*, as illustrated in Figure 23. Secure the Bearing Kit assembly in place with the remaining *Snap Ring* (Side-B).

> **NOTES:**
>
> **A:** Prior to installation, reference Figure 23 for the exact placement of the three *Washers*, which slide over the threaded end of the Combustion Air Blower's shaft. Failure to follow the correct order and direction of the dished surfaces on the *Washers* will result in a restricted rotation of the *Combustion Air Blower*.
>
> **B:** Inspect the *Combustion Air Blower* for warpage and/or damage. If warpage or damage is visible, the *Combustion Air Blower* must be replaced. Reference the Aqua-Hot's "Parts Manual" for spare parts information.

NOTES:

A: Prior to installation, reference Figure 23 for the exact placement of the three *Washers*, which slide over the threaded end of the Combustion Air Blower's shaft. Failure to follow the correct order and direction of the dished surfaces on the *Washers* will result in a restricted rotation of the *Combustion Air Blower*.

B: Inspect the *Combustion Air Blower* for warpage and/or damage. If warpage or damage is visible, the *Combustion Air Blower* must be replaced. Reference the Aqua-Hot's "Parts Manual" for spare parts information.

10. Slide the Combustion Air Blower's shaft (with the three washers) up

Bearings,
continued

through the Bearing Kit assembly until the threaded portion appears on Side-A of the *Blower Casting*; reference Figure 23. Place the new thick flat *Washer* and steel *Drive Gear* on the threaded end of the Combustion Air Blower's shaft. Thread the new *Retaining Nut* on the Combustion Air Blower's shaft until it is finger tight (**DO NOT TIGHTEN**).

11. Place a feeler gauge between the *Combustion Air Blower* and the flat surface of the *Blower Casting*. Slowly tighten (or loosen) the *Retaining Nut*, holding the *Combustion Air Blower*, until a .003 - .005 gap is achieved.

12. Spin the *Combustion Air Blower* to ensure a friction-free rotation.

> **NOTE:** If the *Combustion Air Blower* is rubbing, loosen the *Retaining Nut* slightly and lightly tap on the Combustion Air Blower's shaft (opposite side (i.e., Side-B)), then readjust the gap (repeat Steps 11 and 12).

NOTE: If the *Combustion Air Blower* is rubbing, loosen the *Retaining Nut* slightly and lightly tap on the Combustion Air Blower's shaft (opposite side (i.e., Side-B)), then readjust the gap (repeat Steps 11 and 12).

13. Reattach the *Blower Housing* to the *Blower Casting* using the four *Blower Housing Screws*. Reinstall a *Clutch Hair* on both the Motor's shaft and on the Combustion Air Blower's shaft. Attach the *Motor* and flange assembly, with the recessed edge of the *Motor Flange* in-line with the *Wiring Access Slot* of the *Blower Casting*, to the *Blower Housing* with the three *Hex Head Screws*; reference Figures 13 and 14. Reconnect the *Black (+)* and *Brown (-)* wires of the *Motor* to the C-Plug Harness' *Black (+)* and *Brown (-)* wires; reference Figures 13 and 14. Feed the C-Plug Harness' *Yellow* and *Brown* wires back through the *Wiring Access Hole* in the *Protection Housing*; reference Figure 13.

14. Reinstall the *Protection Housing*. Reconnect the *Black (+)* and *Brown (-) wires* of the *Ignition Coil* to the *C-Plug* Harness' *Yellow (+)* and *Brown (-) wires*; reference Figure 24. Reinstall the *Ignition Coil*, securing it to the *Protection Housing* utilizing the four *Ignition Coil Mounting Screws*; reference Figure 13.

15. Fit the *Fuel Nozzle Manifold Plate* inside the cast-aluminum *Blower Casting* and secure in place with the four *Fuel Nozzle Manifold Plate Screws*. Reattach the *Fuel Supply Line* and *Fuel Return Line* to the *Diesel-Burner Head*.

16. Reconnect the *Violet (+)* and *Brown (-)* wires to the Fuel Solenoid's *(+)* and *(-) Electrical Terminals*; reference Figure 18. Also, reconnect the Flame Sensor's *Green* wire to the *Green C-Plug* Harness *wire* and the *Blue* wire to the *C-Plug* Harness' *Violet wire*; reference Figure 15.

Bearings,
continued

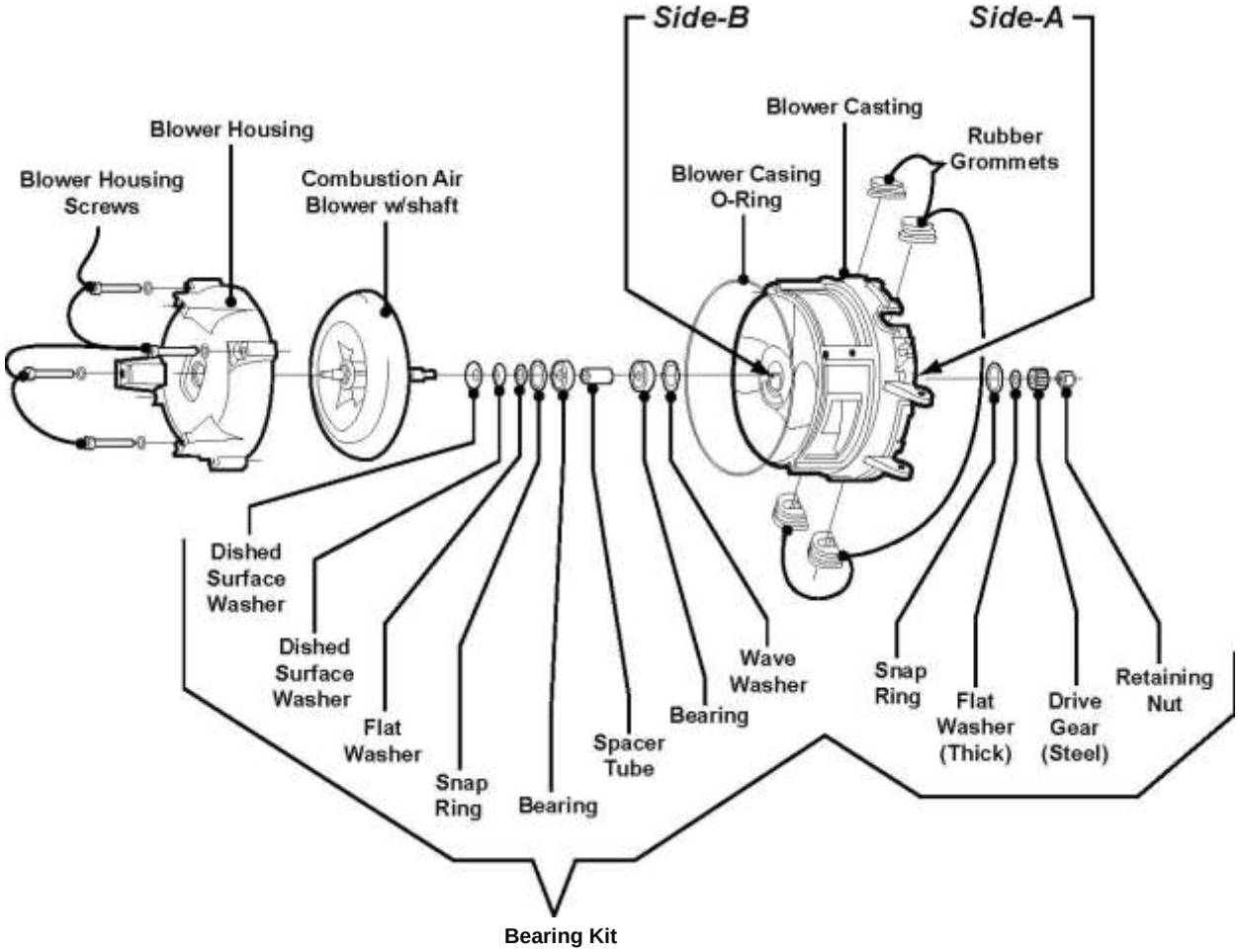


Figure 23

8.10 Ignition Coil

Function: The *Ignition Coil* produces a high voltage ignition spark (approximately 8000 volts), which is released across the metal tips of the *Ignition Electrodes* during the initial *Diesel-Burner* start-up.

WARNING: Use extreme care when testing the *Ignition Coil*, as a **High Voltage Shock** may result.

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

NOTE: In order to perform some of the following procedures, it is necessary to detach and reattach the *Diesel-Burner Head*. Therefore, be sure to review Section 8.2 for detaching and reattaching instructions.

Component Test: Remove the four *Ignition Coil Mounting Screws*, which secure the *Ignition Coil* in place; reference Figure 13. Disconnect the Ignition Coil's *Black (+)* and *Brown (-) wires* from the *C-Plug* Harness' *Yellow (+)* and *Brown (-) wires*. Connect the Ignition Coil *wires* directly to a 12 Volt-DC power supply (i.e., *Black (+) wire* to (+) lead and *Brown (-) wire* to (-) lead). Turn the power supply ***ON*** and watch for a spark to appear across the metal tips of the *Ignition Electrodes*; reference Figure 16. If a spark does not appear, the *Ignition Coil* must be replaced; reference the Ignition Coil's "Replacement Procedure" below. Reference Section 10 for spare parts information.

Cleaning Tips/Maintenance: N/A

Adjustment Procedure: N/A

Replacement Procedure:

1 Disconnect the *Ignition Cables* from the *Ignition Electrodes*; reference Figures 16 and 19. Remove the four *Ignition Coil Mounting Screws*, which secure the *Ignition Coil* to the *Protection Housing*; reference Figure 13. Lift the *Ignition Coil* and disconnect its *wires* from the C-Plug Harness *wires*, prior to removing; reference Figures 3 and 24.

2 Connect the new Ignition Coil's *Black (+)* and *Brown (-)* wires to the C-Plug Harness' *Yellow (+)* and *Brown (-) wires*; reference Figure 24. Attach the *Ignition Coil* to the *Protection Housing* with the four *Ignition Coil Mounting Screws*; then, reconnect the *Ignition Cables* to the *Ignition Electrodes*.

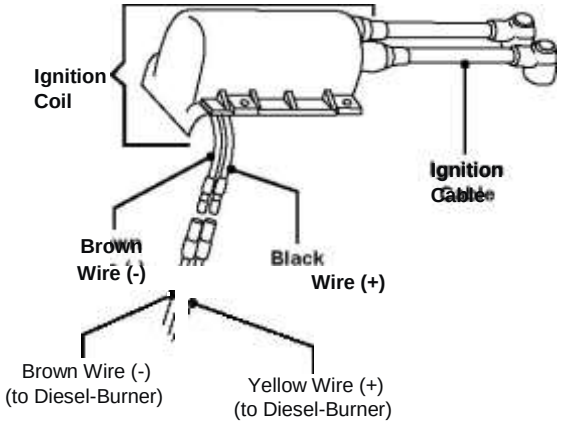


Figure 24

Diesel-Burner Controller

8.11 Diesel-Burner Controller

Function: The *Controller* operates all the components of the *Diesel-Burner Head* and safely shuts the heater ***OFF*** in the event of an overheat, flameout, or low voltage condition. It also receives *Diesel-Burner* operation status signals from the *Flame Sensor*, *VDC Control Thermostat*, and *VDC High-Limit Thermostat*.

NOTE: The functionality of each component can be determined by completing the manual checks, as listed under the "Component Test" area for each individual component, or the components can be tested by using a "Controller Tester." Reference Section 11 for Special Tools information.

Component Test: The following conditions must exist prior to performing the Controller circuit tests in this section. If one of the conditions below does not exist, please contact the Technical Support Department at **1-800-685-4298** for additional assistance.

Condition #1

A battery voltage level of between 11.5 and 14.0 Volts-DC must be present at the *Diesel-Burner's Controller* during all testing; reference Figure 25. It may be necessary to perform a voltage check to ensure that this condition exists. To perform the voltage check, locate the Controller's *B-Plug*, and insert the probes of a DC voltmeter into the *B-4 (+)* and *B-2 (-)* locations; reference Figure 26.

Condition #2

A voltage level of between 11.5 and 14.0 volts must be present at the *Diesel- Burner Controller's**ON/OFF*** switch circuit during all testing. It may be necessary to perform a voltage check to ensure that this condition exists. To perform the voltage check, locate the Controller's *B-Plug*, and insert the probes of a DC voltmeter into the *B-1 (+)* and *B-2 (-)* locations; reference Figures 8 and 26. Turn the *"Diesel"* switch ***ON*** and observe the voltage level; reference Figure 4.

Figure 25

Supply

Diesel Fuel Supply

Diesel Fuel Return

Diesel-Burner Controller,
continued

B-2 (-) Battery Circuit (Brown Wire)
to JP-4 (Pin 4)

COM (-)

(+)

B-Plug B-1 B-2 B-3 B-4 B-6

B-4 (+) Battery Circuit (Red Wire)
to JP-4 (Pin 3)

Figure 26

Diesel-Burner Controller, continued

> **NOTE:** If, after performing the following circuit tests, the *Controller* is determined to be defective and must be replaced, reference the Controller's "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

NOTE: If, after performing the following circuit tests, the *Controller* is determined to be defective and must be replaced, reference the Controller's "Replacement Procedure" in this section. Reference Section 10 for spare parts information.

Ground Circuit Test

Locate the Controller's *B-Plug* and *C-Plug*; reference Figure 8. Insert the probes of a DC voltmeter into the *B-4 (+)* and *C-5 (-)* locations and turn the *"Diesel"* switch ***ON***; reference Figures 4 and 8. If a voltage reading does not register on the voltmeter, the *Controller* must be replaced. If voltage is present, proceed to the next circuit test.

> **NOTE:** The temperature of the Aqua-Hot's Boiler Tank must be below 160°F prior to performing the following tests.

NOTE: The temperature of the Aqua-Hot's Boiler Tank must be below 160°F prior to performing the following tests.

VAC/VDC Control Thermostat Circuit Test

Locate the Controller's *B-Plug* and *C-Plug*; reference Figure 8. Insert the probes of a DC voltmeter into the *C-1 (+)* and *B-2 (-)* locations and turn the *"Diesel"* switch ***ON***; reference Figures 4 and 8. If a voltage reading does not register on the voltmeter, the *Controller* must be replaced. If voltage is present, proceed to the next circuit test.

VDC High-Limit Thermostat Circuit Test

Locate the Controller's *B-Plug* and *C-Plug*; reference Figure 8. Insert the probes of a DC voltmeter into the *C-4 (+)* and *B-2 (-)* locations and turn the *"Diesel"* switch ***ON***; reference Figures 4 and 8. If a voltage reading does not register on the voltmeter, the *Controller* must be replaced. If voltage is present, proceed to the next circuit test.

Motor Circuit Test

Locate the Controller's *C-Plug*; reference Figure 8. Insert the probes of a DC voltmeter into the *C-2 (+)* and *C-5 (-)* locations and turn the *"Diesel"* switch ***ON***; reference Figures 4 and 8. If no voltage reading registers on the voltmeter, the *Controller* must be replaced. If voltage is present, proceed to the next circuit test.

Ignition Coil Circuit Test

Locate the Controller's *C-Plug*; reference Figure 8. Insert the probes of a DC voltmeter into the *C-8 (+)* and *C-5 (-)* locations and turn the *"Diesel"* switch ***ON***; reference Figures 4 and 8. If no voltage reading registers on the voltmeter 18-25 seconds after the Diesel-Burner's initial start-up, the *Controller* must be replaced. If voltage is present, proceed to the next circuit test.

Diesel-Burner Controller, continued

Cleaning Tips/Maintenance: N/A

Adjustment Procedure: N/A

Replacement Procedure:

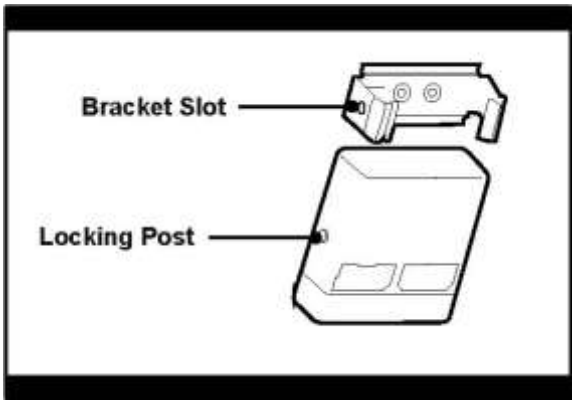
1 Remove both the *B-Plug* and *C-Plug* from the *Controller*; reference Figure 8. Gently pry away each side of the *Controller Mounting Bracket* from the Controller's *locking posts* with a flat-head screwdriver. Once the *locking posts* have been released, pull on the *Controller* to remove it from the *Diesel-Burner Head*.

2 Slide the new *Controller* into the *Controller Mounting Bracket*; reference Figure 27. Push down on the *Controller* until the locking posts snap into the bracket slots. Reinstall both the *B-Plug* and *C-Plug*.

NOTE: Be sure to install the *Controller* with its *C-Plug* and *B-Plug* ports facing downward. Failure to do so will result in moisture collecting in the ports and potential damage to the Controller's internal circuitry; reference Figure 27.

NOTE: Be sure to install the *Controller* with its *C-Plug* and *B-Plug* ports facing downward. Failure to do so will result in moisture collecting in the ports and potential damage to the Controller's internal circuitry; reference Figure 27.

Controller,
continued



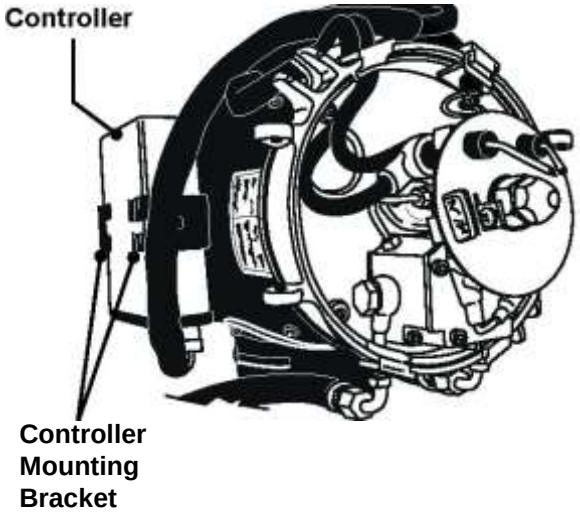


Figure 27

WARRANTY INFORMATION

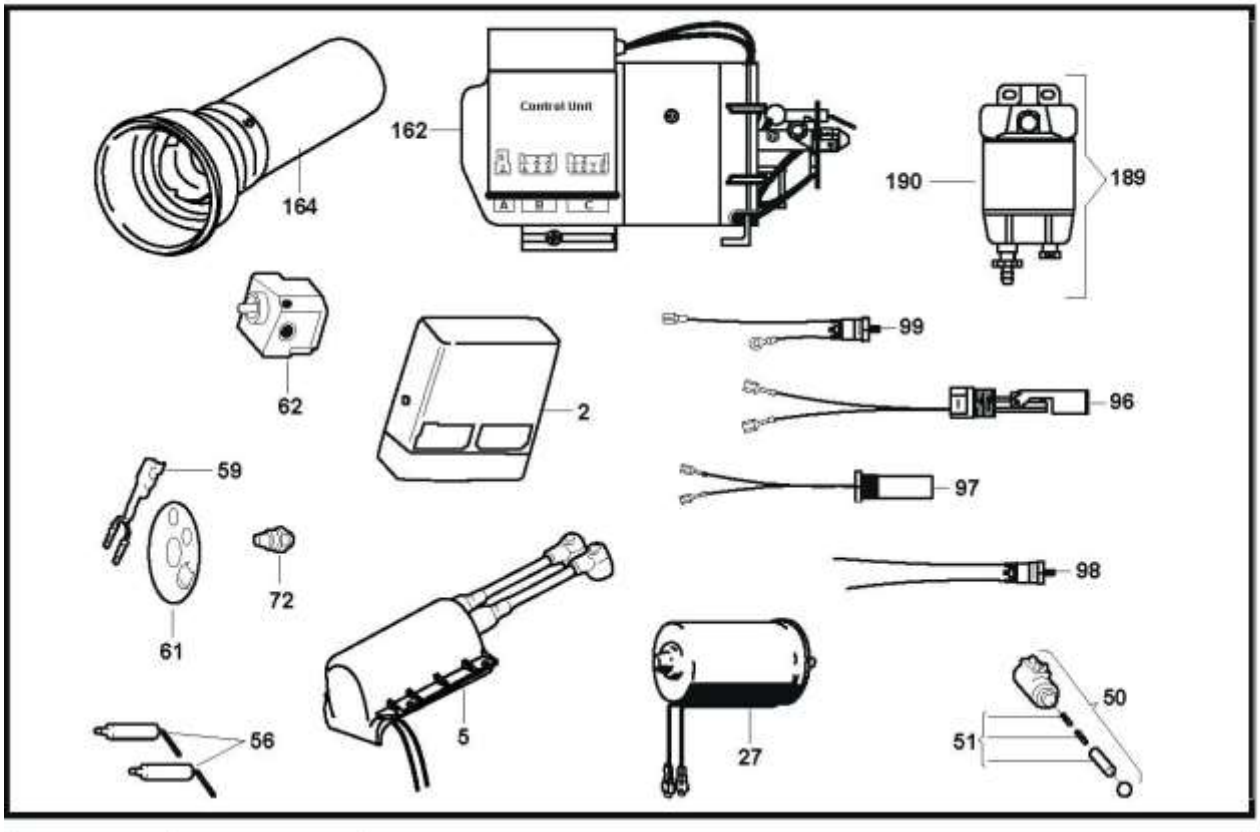
-FOR ALL AQUA-HOT MODELS

Vehicle Systems, Inc. warrants the AQUA-HOT Heater to be free from defects in material and workmanship under normal use and service for a period of two (2) years on both parts and labor commencing upon the original date of registration of the vehicle. The warranty period may not, however, exceed 36 months from the original "Manufactured Date" by Vehicle Systems, Inc. Replacement parts are warranted for the remainder of the Heater's standard warranty period or for six months (180 days), whichever is greater.

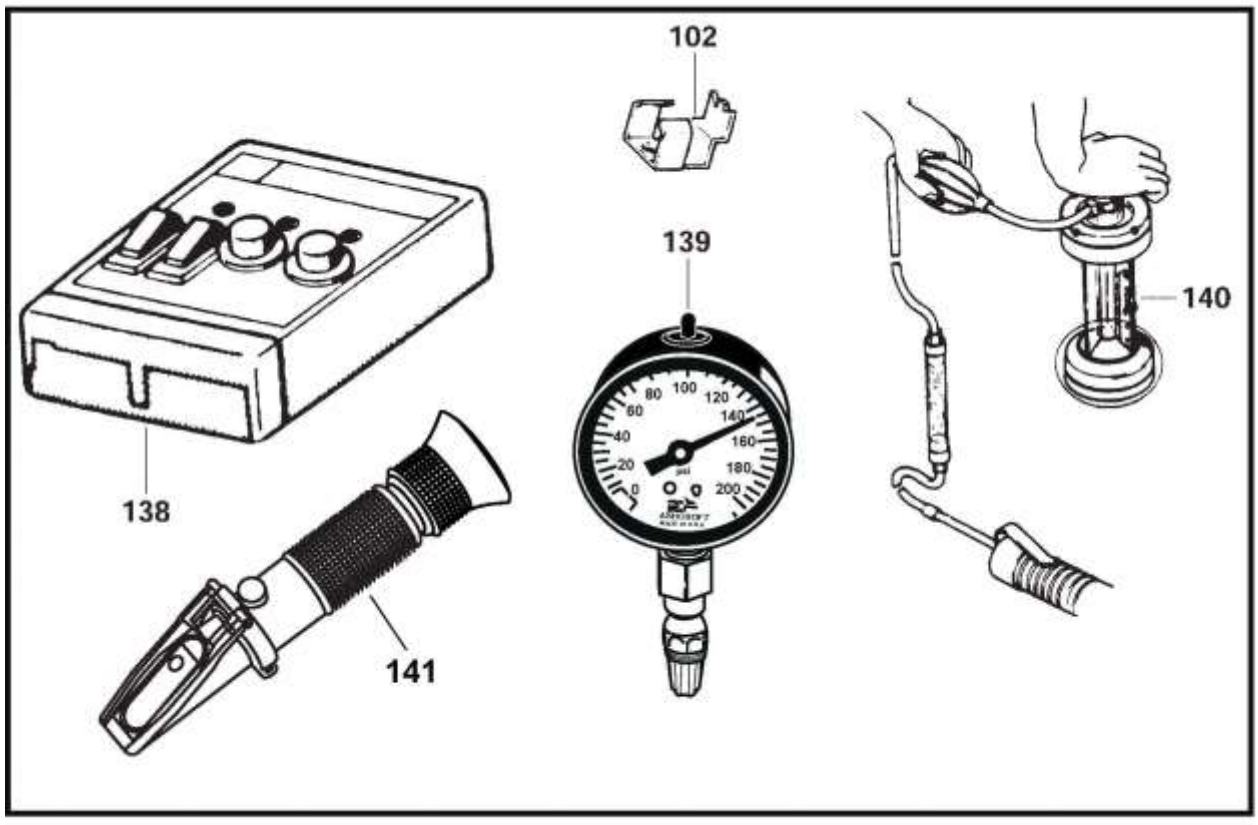
This warranty is conditional upon proper use of the Heater by the end-user. This warranty does not apply to damage or failure of the AQUA-HOT Heater, or the vehicle into which it was installed, due to improper installation, assembly, maintenance, abuse, neglect, accident, or the use of parts no supplied by Vehicle Systems, Inc. Vehicle Systems is not responsible for incidental or consequential damages.

The intent of this warranty is to protect the end-user of the heating system from such defects, which would occur in the manufacture of the product. The warranty is not intended to protect the end-user from problems, which are outside the ability of Vehicle Systems' control.

To obtain warranty repair authorization or for additional product information, please contact the **Technical Support Department** at **1-800-685-4298 (8 AM to 5 PM Mountain Standard Time)**.



2	WPX-287-962	Controller, Diesel-Burner, 12 VDC
5	WPX-101-838	Motor, Combustion Air/Fuel Pump, 12 VDC
2	WPX-425-060	Valve, Fuel Solenoid, 12 VDC
5	WPX-322-083	Valve, Fuel Solenoid, Kit
61	WPX-386-650	Electrode, Ignition
56	WPX-274-313	Sensor, Flame
59	WPX-638-78A	Disc, Photo
61	WPX-887-71A	Pump, Fuel
62	WPX-503-03A	Nozzle, Fuel, 0.35 GPH
72	WPX-886-41A	Switch, Float
96	ELE-800-002	Thermostat, Control 190*F
97	ELE-800-100	Thermostat, High-Limit, 220* F 12 VDC
9	ELE-HLT-322	Thermostat, High-Limit, 220*
99	ELE-ASY-300-FRU	Thermostat, High-Limit, 220* F 120 VAC
99	WPE-905-834	Burner, Diesel, 12 VDC
162	WPX-265-53A	Chamber, Combustion
164	FLX-120-VS1	Filter, Fuel, Kit (DISCONTINUED)
189	FLX-R12-TRA	Filter, Fuel (DISCONTINUED)
190		

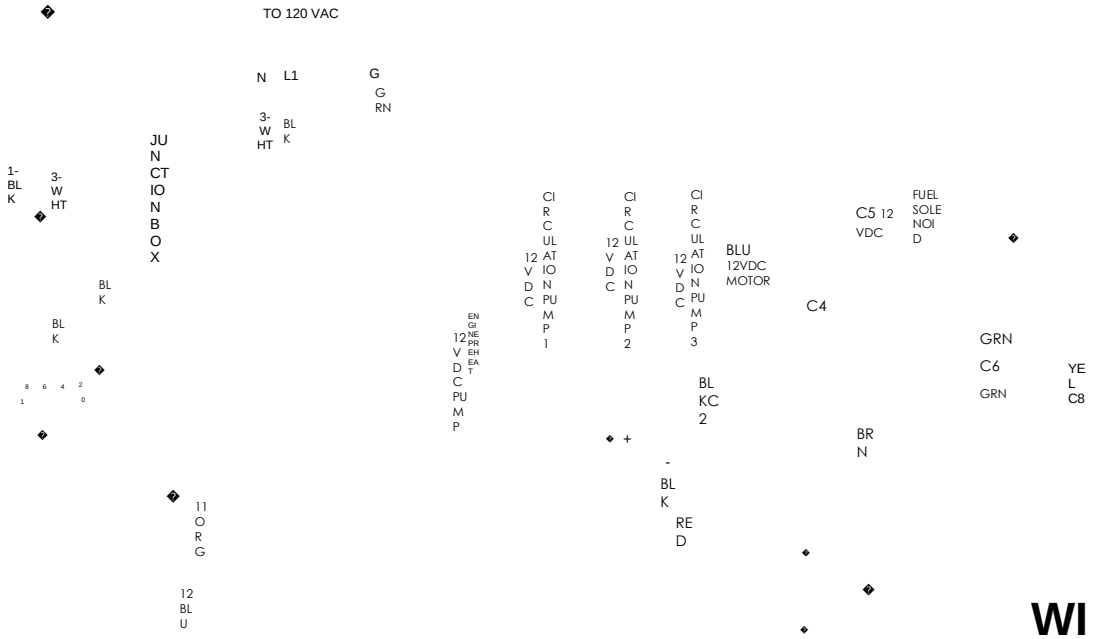


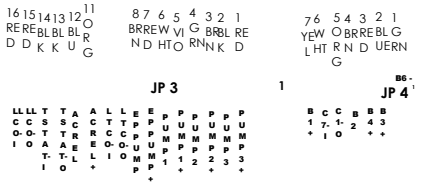
102	WPX-310-646	Gauge, Adjustment, Electrode
138	WPX-440-280	Tester, Controller
139	WPE-600-190	Gauge, Fuel Pressure
140	**********	Gas Analyzer, CO_2 Order Grainger Part # 6T153 from a Grainger Industrial Supply Store near you or visit the Grainger website at www.grainger.com.
141	**********	Refractometer, Battery/Coolant Order Grainger Part # 3MY57 from a Grainger Industrial Supply Store near you or visit the Grainger website at www.grainger.com.

Appendix A

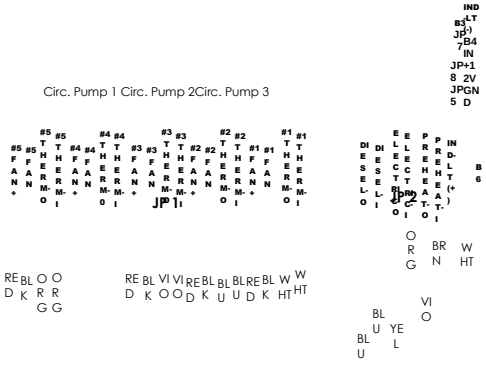
Wiring Diagrams

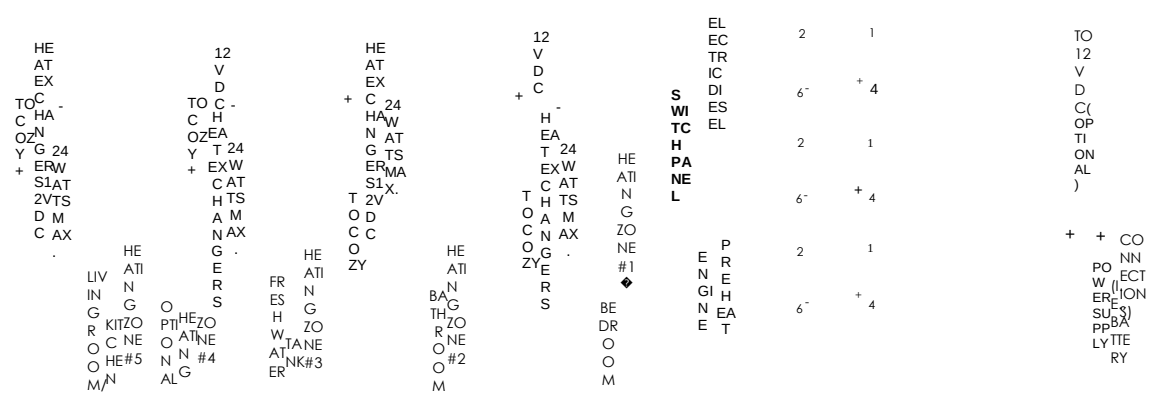
APPENDIX AWIRING INFORMATION (AHE-100-04S)



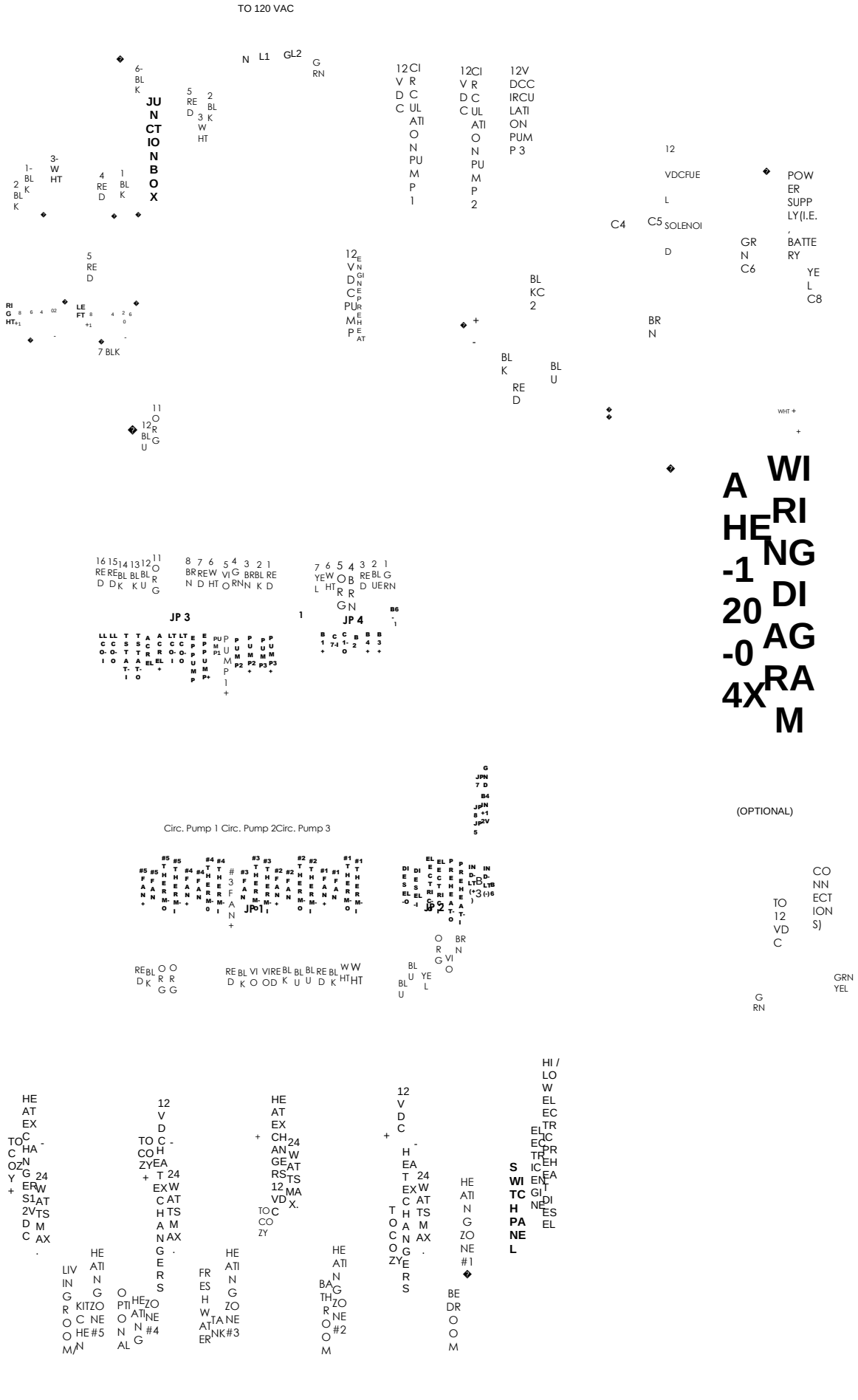


AHE-100-04S WIRING DIAGRAM

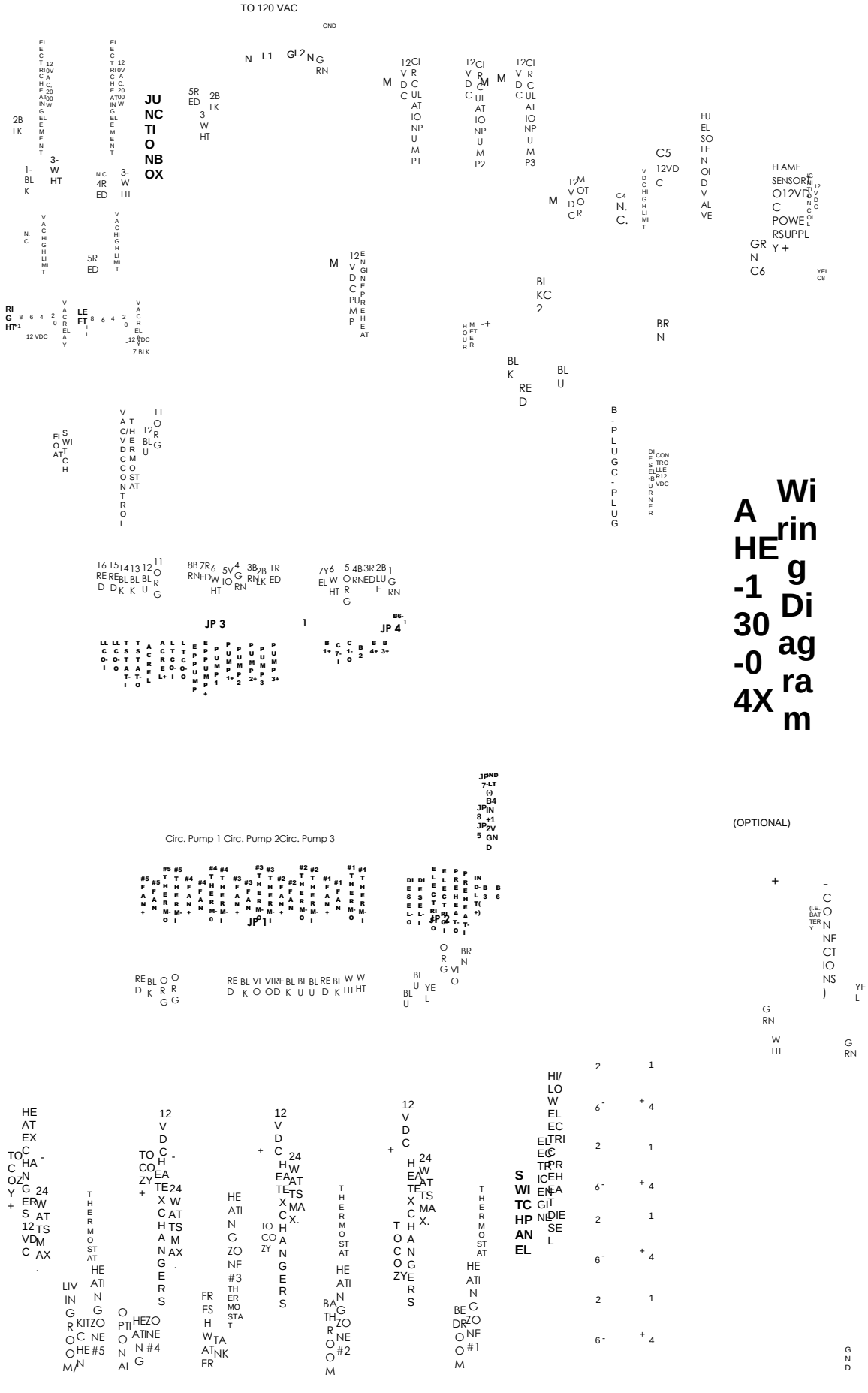




APPENDIX AWIRING INFORMATION (AHE-120-04X)

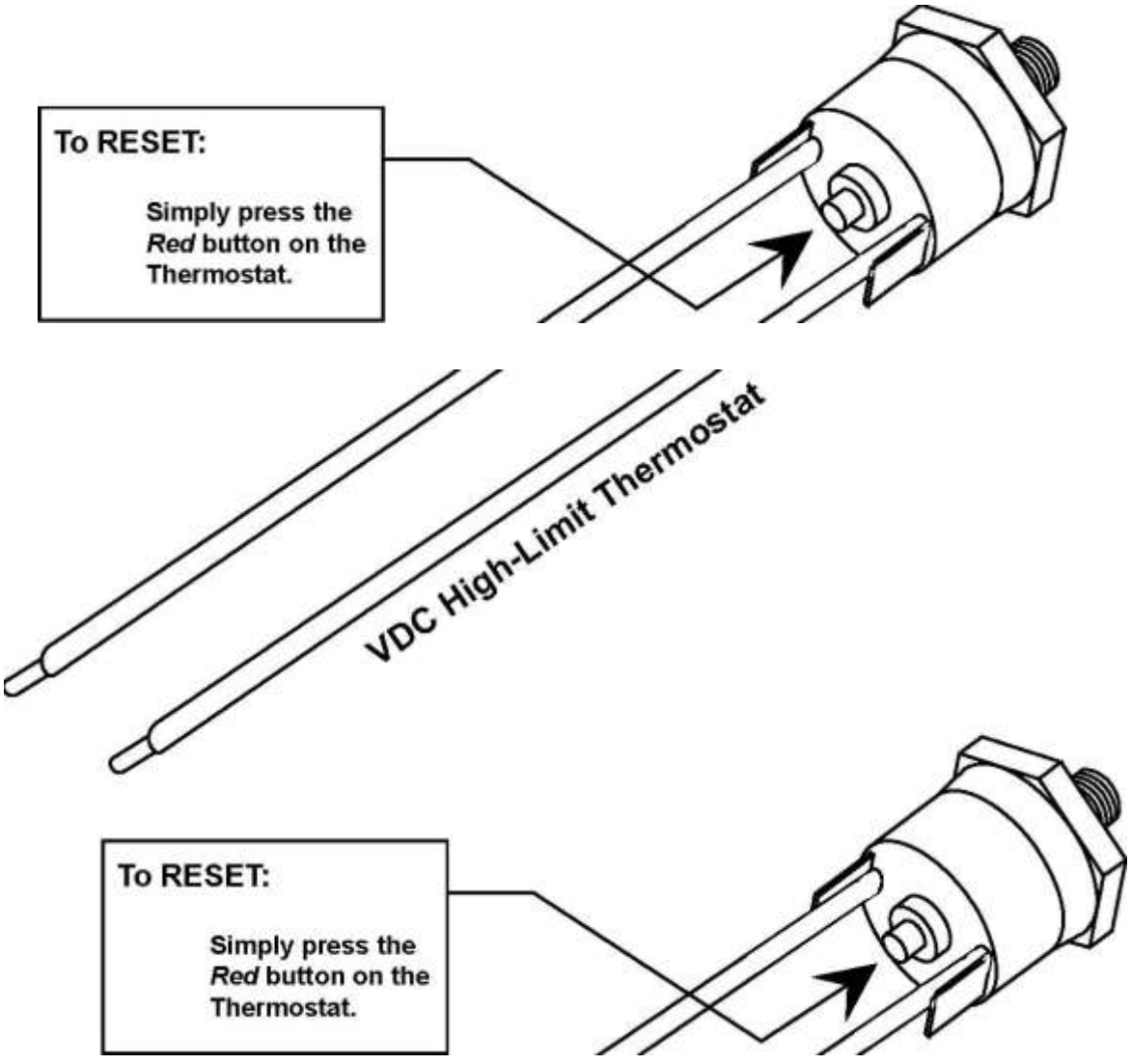


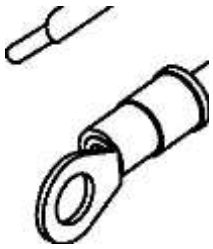
APPENDIX A WIRING INFORMATION (AHE-130-04X)



Appendix B

Illustrations


To RESET:
Simply press the *Red* button on the Thermostat.
VDC High-Limit Thermostat
To RESET:
Simply press the *Red* button on the Thermostat.



Heating Loop #1

Heating Zone #1

Heating Loop #2

Heating Zone #3

Heating Zone #2

Heating Loop #3

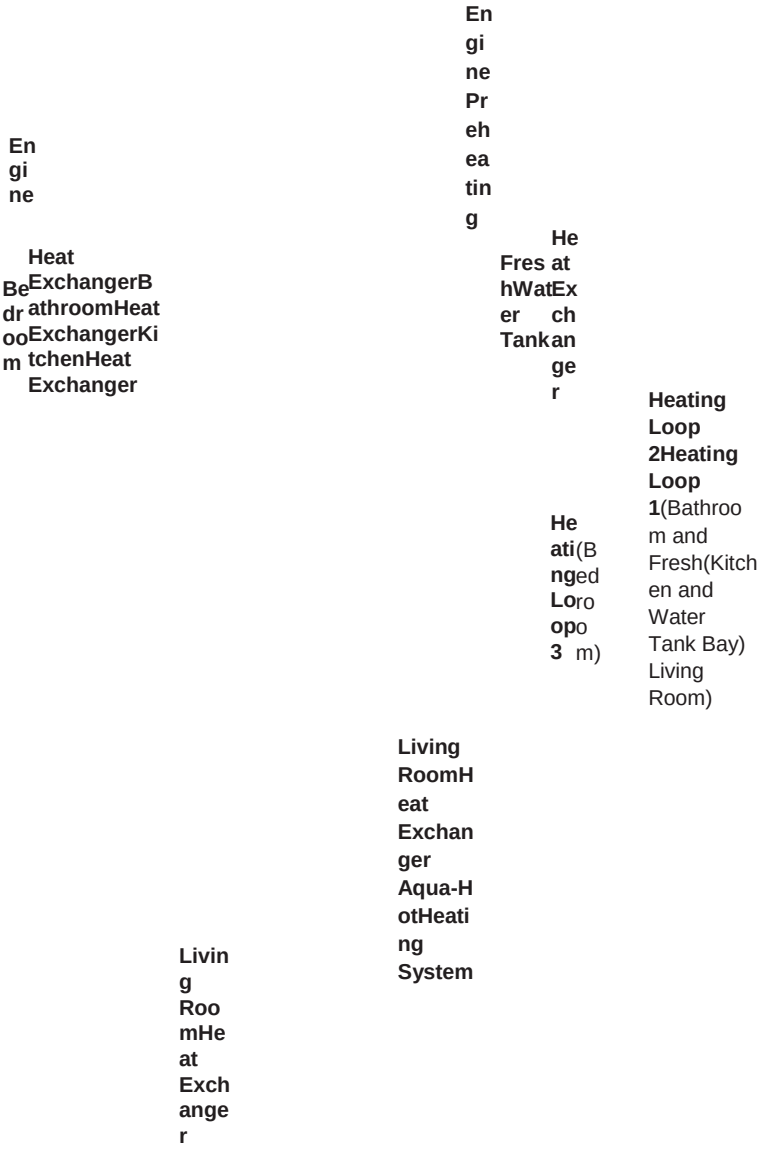
Heating Zone #5

Circulation Pump #1

Circulation Pump #2

Circulation Pump #3

Generalized Motorhome HeatingSystem Floor plan



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